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[illegible]

A KEY TO ARITHMETIC FOR SCHOOLS.

Cambridge:
PRINTED BY C. J. CLAY, M.A.
AT THE UNIVERSITY PRESS.

A KEY

TO

ARITHMETIC FOR SCHOOLS.

BY THE REV.

BARNARD SMITH, M.A.

FELLOW OF ST PETER'S COLLEGE, CAMBRIDGE.

SECOND EDITION.

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MACMILLAN AND CO.
Cambridge:
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London.
1860.

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SOLUTIONS, &c.

NOTATION.

Ex. I. (p. 3.)

1. 63; 81; 99; 40; 13.
2. 200; 303; 764; 888.
3. 4000; 1471; 6930; 9009.
4. 27504; 33000; 9016.
5. 100000; 676050; 202593.
6. 7003000; 11108106; 54054088; 613020303.
7. 2000000000000; 9000000300021; 94000090094904.

NUMERATION.

1. Forty-three; sixty; eighty-eight; ninety-seven; fifty-nine; twelve; twenty-one; nineteen.

2. Two hundred and fifty-six; four hundred and one; five hundred; nine hundred and ninety-nine; three hundred and sixty-five; five hundred and seventy-eight; eight hundred and thirty-seven.

3. Two thousand; one thousand, seven hundred and twenty-four; three thousand and three; seven thousand, five hundred and eighty-four; one thousand and seventy-five; four thousand, five hundred and forty-one.

4. Thirty-seven thousand and three; forty-seven thousand and forty-nine; sixty-three thousand and ninety; eighty thousand and eight; three hundred and forty-one thousand, three hundred and twenty-three.

5. Six millions, eight hundred and fifty thousand, four hundred and six; eight millions, eighty thousand, eight hundred and eight; seven millions, eight hundred and forty-nine thousand, six hundred and thirty; four hundred and eighteen thousand, two hundred and fifty-four.

6. Ten millions and one; twenty millions, two hundred and twenty thousand and twenty-two; ninety-two millions, five hundred and sixty-eight thousand, nine hundred and eighty-seven; thirty millions, one hundred and eighty thousand and seventy.

7. Two thousand five hundred and sixty millions, five hundred and thirty thousand, two hundred; eight hundred millions, three hundred and nine thousand, five hundred and sixty; nine thousand seven hundred and thirty-eight millions, four hundred and thirteen thousand, two hundred and eight.

8. Seven thousand and seventy millions, four hundred and twenty-three; nine hundred and eighty-seven millions, six hundred and fifty-four thousand, three hundred and twenty-one; five thousand seven hundred and seven millions, sixty-eight thousand and eighty.

9. One hundred billions, one hundred and ninety-eight thousand seven hundred millions, ten thousand and ninety; forty-eight thousand seven hundred and twenty-six billions, eight hundred and seventy thousand six hundred and thirty-four millions, one hundred and three thousand, two hundred and sixty-four.

SIMPLE ADDITION.

Ex. II. (p. 6.)

2. 252. 4. 2288. 5. 2073. 6. 12854. 8. 15997. 9. 19258.

10. 112040. 11. 11001543. 13. 3611911. 14. 1148390.

15. 2923038. 16. 1881390. 17. 14547; 48829; 82391.

18. 779264; 2925620. 19. 149036957938; 16696683926; 142228910945.

20. 98929. 21. 4304268. 22. 1002733636293.

SIMPLE SUBTRACTION.

Ex. III. (p. 10.)

2. 445. 3. 221. 4. 86. 5. 1147. 6. 41830.

7. 17359. 8. 432099. 9. 899899. 10. 300368384.

11. 73646889. 12. 6130908; 7036970; 111232112.

13. 115849491; 2922930923; 568990634342. 14. 8087; 4936.

15. 3999996; 99700000. 16. 14515927.

Ex. IV. (p. 11.)

1. XXX; XLVIII; LIX; CCXXII; $\overline{\mathrm{VI}}$; M.DCCC.XLIII.

2. Twenty-three, 23; sixty-nine, 69; two hundred and eighteen, 218; five thousand and one, 5001; one hundred and fifty thousand, six hundred and three, 150603; two millions, one hundred, 2000100.

SIMPLE MULTIPLICATION.

Ex. V. (p. 16.)

2. 2019. **3.** 14335. **4.** 44952. **5.** 14399.

6. 459272. **7.** 24710742. **9.** 395736. **10.** 1098300.

(12)
$$\begin{array}{r} 96843 \\ 17 \\ \hline 677901 \\ 96843 \\ \hline 1646331 \end{array}$$

(13)
$$\begin{array}{r} 87298 \\ 46 \\ \hline 523788 \\ 349192 \\ \hline 4015708 \end{array}$$

(14)
$$\begin{array}{r} 16097 \\ 59 \\ \hline 144873 \\ 80485 \\ \hline 949723 \end{array}$$

(15)
$$\begin{array}{r} 296897 \\ 83 \\ \hline 890691 \\ 2375176 \\ \hline 24642451 \end{array}$$

(17) 840607
80
67248560

(18) 175
189
1575
1400
175
33075

(19) 6298
769
56682
37788
44086
4843162

(21) 25607
5004
102428
128035
128137428

(22) 78847
8803
236541
630776
630776
694090141

(23) 234578
18
1876624
234578
4222404

234578
29
2111202
469156
6802762

234578
53
703734
1172890
12432634

924846
67
6473922
5549076
61964682

924846
95
4624230
8323614
87860370

924846
430
27745380
3699384
397683780

2846067
206
17076402
5692134
586289802

2846067
1008
22768536
2846067
2868835536

2846067
907
19922469
25614603
2581382769

8409631
21711
8409631
8409631
58867417
8409631
16819262
182581498641

8409631
7009
75686679
58867417
58943103679

8409631
8435
42048155
25228893
33638524
67277048
70935237485

8409631
7980
672770480
75686679
58867417
67108855380

(24) 1754
9306
10524
5262
15786
16322724

47506
4500
23753000
190024
213777000

149570
15790
13461300
104699
74785
14957
2361710300

554768
39314
2219072
554768
1664304
4992912
1664304
21810149152

815085
20048
6520680
3260340
1630170
16340824080

123456789
987654321
123456789
246913578
370370367
493827156
617283945
740740734
864197523
987654312
1111111101
121932631112635269

57298492692
700809050321
57298492692
114596985384
171895478076
286492463460
515686434228
458387941536
401089448844
40155302248305278754132

(25)
9487352
4731246
56924112
37949408
18974704
9487352
28462056
66411464
37949408
44886996200592

38015732
400700065
190078660
228094392
266110124
152062928
15232906283422580

574585614865
2837154309
5171270533785
1723756844595
2298342459460
2872928074325
574585614865
4022099304055
1723756844595
4596684918920
1149171229730
1630188053103649203285

4342760
599999
39084840
39084840
39084840
39084840
39084840
21713800
2605651657240

17376872
7399078
139014976
121638104
156391848
156391848
52130616
121638104
128572831324016

(26)
650090
3008
5200720
1950270
1955470720

76008765
9009009
684078885
684078885
684078885
684763647963885

(27)
12
17
84
12
204
19
1836
204
3876

3781
3782
7562
30248
26467
11343
14299742
3783
42899226
114397936
100098194
42899226
54095923986

6565
6786
39390
52520
45955
39390
44550090
9898
356400720
400950810
356400720
400950810
440956790820

(28)
20470
1030
614100
20470
21084100

2958
476
17748
20706
11832
1408008

SIMPLE DIVISION.

Ex. VI. (p. 23.)

(1) 2) 456
228

(2) 2) 90680
45340

(3) 2) 261070308
130535154

(4) 3) 6378
2126

(5) 3) 470850
156950

(6) 3) 385734
128578

(7) 4) 372096
93024

(8) 4) 47392488
11848122

(9) 5) 337625
67525

(10) 5) 9876540
1975308

(11) 6) 890106
148351

(12) 6) 3782046
630341

(13) 7) 623399
89057

(14) 7) 78432407
11204629 with rem. 4.

(15) 8) 164864
20608

(16) 8) 3812312
476539

(17) 9) 7869231
874359

(18) 9) 39237840
4359760

(19) 11) 407792
37072

(20) 11) 91875342
8352303 with rem. 9

(21) 12) 211632
17636

(22) 12) 43600391
3633365 with rem. 11

(23) 13) 404586 (31122
39
14
13
15
13
28
26
26
26

(24) 17) 786543318 (46267254
68
106
102
45
34
114
102
123
119
43
34
91
85
68
68

(25) 2,0) 123456,0
61728

(26) 18) 8224776 (456932
72
102
90
124
108
167
162
57
54
36
36

(27) 27) 14683059 (543817
135
118
108
103
81
220
216
45
27
189
189

(28) 44) 817286228 (18574687
44
377
352
252
220
328
308
206
176
302
264
382
352
308
308

(29) 59) 54906734 (930622
531
180
177
367
354
133
118
154
118
36

(30) 96) 6848734752 (71340987
672
128
96
327
288
393
384
947
864
835
768
672
672

(31) 87) 70865432 (814545
696
126
87
395
348
474
435
393
348
452
435
17

(32) 55) 649305745 (11805559
55
99
55
443
440
305
275
307
275
324
275
495
495

(33) 123) 28894545 (234915
246
429
369
604
492
1125
1107
184
123
615
615

```
(34)  615) 433418175 (704745
           4305
           ----
             2918
             2460
             ----
              4581
              4305
              ----
               2767
               2460
               ----
                3075
                3075
                ----
```

```
(35)  189) 1674918 (8862
           1512
           ----
            1629
            1512
            ----
             1171
             1134
             ----
               378
               378
               ---
```

```
(36)  779) 31884740 (40930
           3116
           ----
             7247
             7011
             ----
              2364
              2337
              ----
                270
```

```
(37)  907) 536819741 (591863
           4535
           ----
            8331
            8163
            ----
             1689
              907
             ----
              7827
              7256
              ----
               5714
               5442
               ----
                2721
                2721
                ----
```

```
(38)  5016,0) 111111111111,1 (22151337
              10032
              -----
               10791
               10032
               -----
                 7591
                 5016
                 -----
                 25751
                 25080
                 -----
                   6711
                   5016
                   -----
                   16951
                   15048
                   -----
                    19031
                    15048
                    -----
                     39831
                     35112
                     -----
                      47191
```

```
(39)  144,0) 823546080,0 (5719070
             720
             ----
             1035
             1008
             ----
               274
               144
              ----
               1306
               1296
               ----
                 1008
                 1008
                 ----
```

```
(40)  7575) 57380625 (7575
            53025
            -----
             43556
             37875
             -----
              56812
              53025
              -----
               37875
               37875
               -----
```

(41) 5406) 353008972662 (65299477
32436
28648
27030
16189
10812
53777
48654
51232
48654
25786
21624
41626
37842
37842
37842

(42) 2468) 599961567212 (243096259
4936
10636
9872
7641
7404
23756
22212
15447
14808
6392
4936
14561
12340
22212
22212

(43) 789,0000) 2679953,4687 (3396
2367
3129
2367
7625
7101
5243
4734
5094687

(44) 3851) 57111104051 (14830201
3851
18601
15404
31971
30808
11630
11553
7740
7702
3851
3851

(45) 1111) 10000000000000000 (9000900090009
9999
10000
9999
10000
9999
10000
9999
1

11111) 10000000000000000 (900009000090
99999
100000
99999
100000
99999
10

```
(46)  1646,00) 6343945,67 (3854
               4938
               ----
               14059
               13168
               -----
                 8914
                 8230
                 ----
                  6845
                  6584
                  ----
                   26167
```

```
(47)  90009) 67157148372 (746115
             630063
             ------
              415084
              360036
              ------
               550488
               540054
               ------
                104343
                 90009
                ------
                 143347
                  90009
                 ------
                  533382
                  450045
                  ------
                   83337
```

```
(48)  200563) 1220225292 (6084
              1203378
              -------
               1684729
               1604504
               -------
                 802252
                 802252
                 ------
```

```
(49)  8496427) 7428927415293 (874359
               67971416
               --------
                63178581
                59474989
                --------
                 37035925
                 33985708
                 --------
                  30502172
                  25489281
                  --------
                   50128919
                   42482135
                   --------
                    76467843
                    76467843
                    --------
```

```
(50)  79094451) 60435674536845 (764095
                553661157
                ---------
                 506955883          8
                 474566706
                 ---------
                  323691776
                  316377804
                  ---------
                    751397284
                    711850059
                    ---------
                     395472255
                     395472255
                     ---------
```

```
(51) 5578) 65358547823 (11717201
           5578
           ----
            9578
            5578
            -----
            40005
            39046
            -----
              9594
              5578
              -----
              40167
              39046
              -----
               11218
               11156
               -----
                  6223
                  5578
                  ----
                   645
```

```
(52) 687637943) 3968901531620 (5771
                3438189715
                ----------
                 5307118166
                 4813465601
                 ----------
                  4936525652
                  4813465601
                  ----------
                   1230600510
                    687637943
                    ---------
                    542962567
```

```
(53) 3854) 152181255 (39486
           11562
           -----
            36561
            34686
            -----
             18752
             15416
             -----
              33365
              30832
              -----
               25335
               23124
               -----
                2211
```

```
(54) 4093) 143255 (35
           12279
           -----
            20465
            20465
            -----
```

```
(55) 72) 203534191 (2826863
         144
         ---
          595
          576
          ---
           193
           144
           ---
            494
            432
            ---
             621
             576
             ---
              459
              432
              ---
               271
               216
               ---
                55
```

```
  (8 | 203534191—7 ) 55
72{  | ------------ }
  (9 |  25441773—6 )
     | -----------
     |  2826863, with rem. 55.
```

GREATEST COMMON MEASURE.

Ex. VII. (p. 26.)

1. (1) 16) 72 (4
64
8) 16 (2
16
∴ 8 is G. C. M.

(2) 30) 75 (2
60
15) 30 (2
30
∴ 15 is G. C. M.

(3) 63) 99 (1
63
36) 63 (1
36
27) 36 (1
27
9) 27 (3
27
∴ 9 is G. C. M.

(4) 55) 121 (2
110
11) 55 (5
55
∴ 11 is G. C. M.

(5) 128) 324 (2
256
68) 128 (1
68
60) 68 (1
60
8) 60 (7
56
4) 8 (2
8
∴ 4 is G. C. M.

(6) 120) 320 (2
240
80) 120 (1
80
40) 80 (2
80
∴ 40 is G. C. M.

(7) 272) 425 (1
272
153) 272 (1
153
119) 153 (1
119
34) 119 (3
102
17) 34 (2
34
∴ 17 is G. C. M.

(8) 394) 672 (1
394
278) 394 (1
278
116) 278 (2
232
46) 116 (2
92
24) 46 (1
24
22) 24 (1
22
2) 22 (11
22
∴ 2 is G. C. M.

(9) 720) 860 (1
720
140) 720 (5
700
20) 140 (7
140
∴ 20 is G. C. M.

(10) 825) 960 (1
825
135) 825 (6
810
15) 135 (9
135
∴ 15 is G. C. M.

(11) 775) 1800 (2
1550
250) 775 (3
750
25) 250 (10
250
∴ 25 is G. C. M.

(12) 856) 936 (1
856
80) 856 (10
80
56) 80 (1
56
24) 56 (2
48
8) 24 (3
24
∴ 8 is G. C. M.

(13) 176) 1000 (5
880
120) 176 (1
120
56) 120 (2
112
8) 56 (7
56
∴ 8 is G. C. M.

(14) 1236) 1632 (1
1236
396) 1236 (3
1188
48) 396 (8
384
12) 48 (4
48
∴ 12 is G. C. M.

(15) 6409) 7395 (1
6409
986) 6409 (6
5916
493) 986 (2
986
∴ 493 is G. C. M.

(16) 689) 1573 (2
1378
195) 689 (3
585
104) 195 (1
104
91) 104 (1
91
13) 91 (7
91
∴ 13 is G. C. M.

(17)
```
1729)5850(3
     5187
      663)1729(2
          1326
           403)663(1
               403
               260)403(1
                   260
                   143)260(1
                       143
                       117)143(1
                           117
                            26)117(4
                               104
                                13)26(2
                                   26
```
∴ 13 is G. C. M.

(18)
```
5210)5718(1
     5210
      508)5210(10
          508
           130)508(3
               390
               118)130(1
                   118
                    12)118(9
                       108
                        10)12(1
                           10
                            2)10(5
                              10
```
∴ 2 is G. C. M.

(19)
```
2023)7581(3
     6069
     1512)2023(1
          1512
           511)1512(2
               1022
                490)511(1
                    490
                     21)490(23
                        42
                         70
                         63
                          7)21(3
                            21
```
∴ 7 is G. C. M.

(20)
```
468)1266(2
    936
    330)468(1
        330
        138)330(2
            276
             54)138(2
                108
                 30)54(1
                    30
                    24)30(1
                       24
                        6)24(4
                          24
```
∴ 6 is G. C. M.

(21)
```
2484)2628(1
     2484
      144)2484(17
          144
          1044
          1008
            36)144(4
               144
```
∴ 36 is G. C. M.

```
(22) 2268) 3444 (1
           2268
           1176) 2268 (1
                 1176
                 1092) 1176 (1
                       1092
                         84) 1092 (13
                             84
                             252
                             252

     ∴ 84 is G. C. M.
```

```
(23) 5544) 6552 (1
           5544
           1008) 5544 (5
                 5040
                  504) 1008 (2
                       1008

     ∴ 504 is G. C. M.
```

```
(24) 2573) 4067 (1
           2573
           1494) 2573 (1
                 1494
                 1079) 1494 (1
                       1079
                        415) 1079 (2
                             830
                             249) 415 (1
                                  249
                                  166) 249 (1
                                       166
                                        83) 166 (2
                                            166

     ∴ 83 is G. C. M.
```

```
(25) 10395) 16819 (1
            10395
             6424) 10395 (1
                   6424
                   3971) 6424 (1
                         3971
                         2453) 3971 (1
                               2453
                               1518) 2453 (1
                                     1518
                                      935) 1518 (1
                                           935
                                           583) 935 (1
                                                583
                                                352) 583 (1
                                                     352
                                                     231) 352 (1
                                                          231
                                                          121) 231 (1
                                                               121
                                                               110) 121 (1
                                                                    110
                                                                     11) 110
                                                                         11

     ∴ 11 is G. C. M.
```

(26) 80934) 110331 (1
80934
29397) 80934 (2
58794
22140) 29397 (1
22140
7257) 22140 (3
21771
369) 7257 (19
369
3567
3321
246) 369 (1
246
123) 246 (2
246

∴ 123 is G. C. M.

(27) 1242) 2323 (1
1242
1081) 1242 (1
1081
161) 1081 (6
966
115) 161 (1
115
46) 115 (2
92
23) 46 (2
46

∴ 23 is G. C. M.

(28) 13536) 23148 (1
13536
9612) 13536 (1
9612
3924) 9612 (2
7848
1764) 3924 (2
3528
396) 1764 (4
1584
180) 396 (2
360
36) 180 (5
180

∴ 36 is G. C. M.

(29) 42237) 75582 (1
42237
33345) 42237 (1
33345
8892) 33345 (3
26676
6669) 8892 (1
6669
2223) 6669 (3
6669

∴ 2223 is G. C. M.

(30) 285714) 999999 (3
857142
142857) 285714 (2
285714

∴ 142857 is G. C. M.

(31) 10353) 14877 (1
10353
4524) 10353 (2
9048
1305) 4524 (3
3915
609) 1305 (2
1218
87) 609 (7
609

∴ 87 is G. C. M.

(32) 30599) 271469 (8
244792
26677) 30599 (1
26677
3922) 26677 (6
23532
3145) 3922 (1
3145
777) 3145 (4
3108
37) 777 (21
74
37
37

∴ 37 is G. C. M.

2. (1) 14) 18 (1
14
4) 14 (3
12
2) 4 (2
4

∴ 2 is G. C. M. of 14 and 18.

2) 24 (12
24

∴ 2 is G. C. M. required.

(2) 16) 24 (1
16
8) 16 (2
16

∴ 8 is the G. C. M. of 16 and 24.

8) 48 (6
48

∴ 8 is the G. C. M. of 16, 24, and 48.

8) 74 (9
72
2) 8 (4
8

∴ 2 is the G. C. M. required.

(3) 13) 52 (4
52

∴ 13 is G. C. M. of 13 and 52.

13) 416 (32
39
26
26

∴ 13 is G. C. M. of 13, 52, and 416.

13) 78 (6
78

∴ 13 is G. C. M. required.

(4) 837) 1134 (1
837
297) 837 (2
594
243) 297 (1
243
54) 243 (4
216
27) 54 (2
54

∴ 27 is G. C. M. of 837 and 1134.

27) 1347 (49
108
267
243
24) 27 (1
24
3) 24 (8
24

∴ 3 is the G. C. M. required.

(5) 805) 1311 (1
805
506) 805 (1
506
299) 506 (1
299
207) 299 (1
207
92) 207 (2
184
23) 92 (4
92

∴ 23 is G. C. M. of 805 and 1311.

23) 1978 (86
184
138
138

∴ 23 is G. C. M. required.

(6) 28) 84 (3
84

∴ 28 is G. C. M. of 28 and 84.

28) 154 (5
140
14) 28 (2
28

∴ 14 is G. C. M. of 28, 84, and 154.

14) 343 (24
28
63
56
7) 14 (2
14

∴ 7 is the G. C. M. required.

(7) 504) 5292 (10
504
252) 504 (2
504

∴ 252 is G. C. M. of 504 and 5292.

252) 1520 (6
1512
8) 252 (31
24
12
8
4) 8 (2
8

∴ 4 is G. C. M. required.

(8) 396) 5184 (13
396
1224
1188
36) 396 (11
36
36
36

∴ 36 is G. C. M. of 396 and 5184.

36) 6914 (192
36
331
324
74
72
2) 36 (18
36

∴ 2 is G. C. M. required.

LEAST COMMON MULTIPLE.

Ex. VIII. (p. 30.)

1. (1) 16) 24 (1
16
8) 16 (2
16

∴ 8 is the G. C. M. of 16 and 24;

$$\therefore \text{L. C. M.} = \frac{16 \times 24}{8} = \frac{384}{8} = 48.$$

(2) 36) 75 (2
72
3) 36 (12
36

∴ 3 is the G. C. M. of 36 and 75;

$$\therefore \text{L. C. M.} = \frac{36 \times 75}{3} = \frac{2700}{3} = 900.$$

(3) 7) 15 (2
14
1) 7 (7
7

∴ 1 is the G. C. M. of 7 and 15;

$$\therefore \text{L. C. M.} = \frac{7 \times 15}{1} = 105.$$

(4)

```
28) 35 (1
    28
    --
     7) 28 (4
        28
        --
```

∴ 7 is the G. C. M. of 28 and 35;

$$\therefore \text{L. C. M.} = \frac{28 \times 35}{7} = \frac{980}{7} = 140.$$

(5)

```
319) 407 (1
     319
     ---
      88) 319 (3
          264
          ---
           55) 88 (1
               55
               --
               33) 55 (1
                   33
                   --
                   22) 33 (1
                       22
                       --
                       11) 22 (2
                           22
                           --
```

∴ 11 is the G. C. M. of 319 and 407;

$$\therefore \text{L. C. M.} = \frac{319 \times 407}{11} = \frac{129833}{11} = 11803.$$

(6)

```
333) 504 (1
     333
     ---
     171) 333 (1
          171
          ---
          162) 171 (1
               162
               ---
                 9) 162 (18
                    9
                    --
                    72
                    72
                    --
```

∴ 9 is the G. C. M. of 333 and 504;

$$\therefore \text{L. C. M.} = \frac{333 \times 504}{9} = \frac{167832}{9} = 18648.$$

(7) 799) 2961 (3
2397
564) 799 (1
564
235) 564 (2
470
94) 235 (2
188
47) 94 (2
94

∴ 47 is the G. C. M. of 2961 and 799;

$$\therefore \text{L. C. M.} = \frac{2961 \times 799}{47} = \frac{2365839}{47} = 50337.$$

(8) 7568) 9504 (1
7568
1936) 7568 (3
5808
1760) 1936 (1
1760
176) 1760 (10
1760

∴ 176 is the G. C. M. of 7568 and 9504;

$$\therefore \text{L. C. M.} = \frac{7568 \times 9504}{176} = \frac{71926272}{176} = 408672.$$

(9) 4662) 5476 (1
4662
814) 4662 (5
4070
592) 814 (1
592
222) 592 (2
444
148) 222 (1
148
74) 148 (2
148

∴ 74 is the G. C. M. of 4662 and 5476;

$$\therefore \text{L. C. M.} = \frac{4662 \times 5476}{74} = \frac{25529112}{74} = 344988.$$

(10) 6327) 23997 (3
18981
5016) 6327 (1
5016
1311) 5016 (3
3933
1083) 1311 (1
1083
228) 1083 (4
912
171) 228 (1
171
57) 171 (3
171

∴ 57 is the G. C. M. of 6327 and 23997;

$$\therefore \text{L. C. M.} = \frac{6327 \times 23997}{57} = \frac{151829019}{57} = 2663667.$$

(11) 5415) 30105 (5
27075
3030) 5415 (1
3030
2385) 3030 (1
2385
645) 2385 (3
1935
450) 645 (1
450
195) 450 (2
390
60) 195 (3
180
15) 60 (4
60

∴ 15 is the G. C. M. of 5415 and 30105;

$$\therefore \text{L. C. M.} = \frac{5415 \times 30105}{15}$$

$$= \frac{163018575}{15}$$

$$= 10867905.$$

(12)

$$\begin{array}{l}
15863\,)\,21489\,(1 \\
\qquad\quad \underline{15863} \\
\qquad\quad 5626\,)\,15863\,(2 \\
\qquad\qquad\qquad \underline{11252} \\
\qquad\qquad\qquad 4611\,)\,5626\,(1 \\
\qquad\qquad\qquad\qquad\quad \underline{4611} \\
\qquad\qquad\qquad\qquad\quad 1015\,)\,4611\,(4 \\
\qquad\qquad\qquad\qquad\qquad\qquad \underline{4060} \\
\qquad\qquad\qquad\qquad\qquad\qquad 551\,)\,1015\,(1 \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad \underline{551} \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad 464\,)\,551\,(1 \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad \underline{464} \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad 87\,)\,464\,(5 \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad \underline{435} \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad 29\,)\,87\,(3 \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad \underline{87}
\end{array}$$

∴ 29 is the G. C. M. of 15863 and 21489;

$$\therefore \text{L. C. M.} = \frac{15863 \times 21489}{29}$$

$$= \frac{340880007}{29}$$

$$= 11754483.$$

2. (1)

$$\begin{array}{r|l}
2 & 12,\ 8,\ 9 \\ \hline
2 & 6,\ 4,\ 9 \\ \hline
3 & 3,\ 2,\ 9 \\ \hline
 & 1,\ 2,\ 3
\end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 2 \times 3$
$= 72.$

(2)

$$\begin{array}{r|l}
2 & 8,\ 12,\ 16 \\ \hline
2 & 4,\ 6,\ 8 \\ \hline
2 & 2,\ 3,\ 4 \\ \hline
 & 1,\ 3,\ 2
\end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 2 \times 3 \times 2$
$= 48.$

(3)

$$\begin{array}{r|l}
2 & 6,\ 10,\ 15 \\ \hline
3 & 3,\ 5,\ 15 \\ \hline
5 & 1,\ 5,\ 5 \\ \hline
 & 1,\ 1,\ 1
\end{array}$$

$\therefore$ L. C. M. $= 2 \times 3 \times 5$
$= 30.$

(4)

$$\begin{array}{r|l}
2 & 8,\ 12,\ 20 \\ \hline
2 & 4,\ 6,\ 10 \\ \hline
 & 2,\ 3,\ 5
\end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 2 \times 3 \times 5$
$= 120.$

(5)
$$\begin{array}{r|l} 3 & 27,\ 24,\ 15 \\ \hline & 9,\ \ 8,\ \ 5 \end{array}$$

$\therefore$ L. C. M. $= 3 \times 9 \times 8 \times 5$
$= 1080.$

(6)
$$\begin{array}{r|r} 2 & 12,\ 51,\ 68 \\ \hline 2 & 6,\ 51,\ 34 \\ \hline 3 & 3,\ 51,\ 17 \\ \hline 17 & 1,\ 17,\ 17 \\ \hline & 1,\ \ 1,\ \ 1 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 17$
$= 204.$

(7)
$$\begin{array}{r|l} 19 & 19,\ 29,\ 38 \\ \hline & 1,\ 29,\ \ 2 \end{array}$$

$\therefore$ L. C. M. $= 19 \times 29 \times 2$
$= 1102.$

(8)
$$\begin{array}{r|r} 2 & 24,\ 48,\ 64,\ 192 \\ \hline 2 & 12,\ 24,\ 32,\ 96 \\ \hline 2 & 6,\ 12,\ 16,\ 48 \\ \hline 2 & 3,\ 6,\ 8,\ 24 \\ \hline 2 & 3,\ 3,\ 4,\ 12 \\ \hline 2 & 3,\ 3,\ 2,\ 6 \\ \hline 3 & 3,\ 3,\ 1,\ 3 \\ \hline & 1,\ 1,\ 1,\ 1 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3$
$= 192.$

(9)
$$\begin{array}{r|r} 2 & 63,\ 12,\ 84,\ 14 \\ \hline 2 & 63,\ 6,\ 42,\ 7 \\ \hline 3 & 63,\ 3,\ 21,\ 7 \\ \hline 7 & 21,\ 1,\ 7,\ 7 \\ \hline & 3,\ 1,\ 1,\ 1 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 7 \times 3$
$= 252.$

(10)
$$\begin{array}{r|r} 3 & 5,\ 7,\ 9,\ 11,\ 15 \\ \hline 5 & 5,\ 7,\ 3,\ 11,\ 5 \\ \hline & 1,\ 7,\ 3,\ 11,\ 1 \end{array}$$

$\therefore$ L. C. M. $= 3 \times 5 \times 7 \times 3 \times 11$
$= 3465.$

(11)
$$\begin{array}{r|r} 2 & 6,\ 15,\ 24,\ 25 \\ \hline 3 & 3,\ 15,\ 12,\ 25 \\ \hline 5 & 1,\ 5,\ 4,\ 25 \\ \hline & 1,\ 1,\ 4,\ 5 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 3 \times 5 \times 4 \times 5$
$= 600.$

(12)
$$\begin{array}{r|r} 2 & 12,\ 18,\ 30,\ 48,\ 60 \\ \hline 2 & 6,\ 9,\ 15,\ 24,\ 30 \\ \hline 3 & 3,\ 9,\ 15,\ 12,\ 15 \\ \hline 5 & 1,\ 3,\ 5,\ 4,\ 5 \\ \hline & 1,\ 3,\ 1,\ 4,\ 1 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 5 \times 3 \times 4$
$= 720.$

(13)
$$\begin{array}{r|r} 3 & 15,\ 35,\ 63,\ 72 \\ \hline 3 & 5,\ 35,\ 21,\ 24 \\ \hline 5 & 5,\ 35,\ 7,\ 8 \\ \hline 7 & 1,\ 7,\ 7,\ 8 \\ \hline & 1,\ 1,\ 1,\ 8 \end{array}$$

$\therefore$ L. C. M. $= 3 \times 3 \times 5 \times 7 \times 8$
$= 2520.$

(14)
$$\begin{array}{r|rrrr} 2 & 9, & 12, & 14, & 210 \\ \hline 3 & 9, & 6, & 7, & 105 \\ \hline 7 & 3, & 2, & 7, & 35 \\ \hline & 3, & 2, & 1, & 5 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 3 \times 7 \times 3 \times 2 \times 5$
$= 1260.$

(15)
$$\begin{array}{r|rrrr} 2 & 54, & 81, & 63, & 14 \\ \hline 3 & 27, & 81, & 63, & 7 \\ \hline 3 & 9, & 27, & 21, & 7 \\ \hline 3 & 3, & 9, & 7, & 7 \\ \hline 7 & 1, & 3, & 7, & 7 \\ \hline & 1, & 3, & 1, & 1 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 3 \times 3 \times 3 \times 7 \times 3$
$= 1134.$

(16)
$$\begin{array}{r|rrrrr} 2 & 24, & 10, & 32, & 45, & 25 \\ \hline 2 & 12, & 5, & 16, & 45, & 25 \\ \hline 2 & 6, & 5, & 8, & 45, & 25 \\ \hline 3 & 3, & 5, & 4, & 45, & 25 \\ \hline 5 & 1, & 5, & 4, & 15, & 25 \\ \hline & 1, & 1, & 4, & 3, & 5 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 2 \times 3 \times 5 \times 4 \times 3 \times 5$
$= 7200.$

(17)
$$\begin{array}{r|rrrrrrrrr} 2 & 1, & 2, & 3, & 4, & 5, & 6, & 7, & 8, & 9 \\ \hline 2 & 1, & 1, & 3, & 2, & 5, & 3, & 7, & 4, & 9 \\ \hline 3 & 1, & 1, & 3, & 1, & 5, & 3, & 7, & 2, & 9 \\ \hline & 1, & 1, & 1, & 1, & 5, & 1, & 7, & 2, & 3 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 5 \times 7 \times 2 \times 3$
$= 2520.$

(18)
$$\begin{array}{r|rrrrrrr} 2 & 7, & 8, & 9, & 18, & 24, & 72, & 144 \\ \hline 2 & 7, & 4, & 9, & 9, & 12, & 36, & 72 \\ \hline 2 & 7, & 2, & 9, & 9, & 6, & 18, & 36 \\ \hline 3 & 7, & 1, & 9, & 9, & 3, & 9, & 18 \\ \hline 3 & 7, & 1, & 3, & 3, & 1, & 3, & 6 \\ \hline & 7, & 1, & 1, & 1, & 1, & 1, & 2 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 2 \times 3 \times 3 \times 7 \times 2$
$= 1008.$

(19)
$$\begin{array}{r|rrrrrrr} 2 & 12, & 20, & 24, & 54, & 81, & 63, & 14 \\ \hline 2 & 6, & 10, & 12, & 27, & 81, & 63, & 7 \\ \hline 3 & 3, & 5, & 6, & 27, & 81, & 63, & 7 \\ \hline 3 & 1, & 5, & 2, & 9, & 27, & 21, & 7 \\ \hline 3 & 1, & 5, & 2, & 3, & 9, & 7, & 7 \\ \hline 7 & 1, & 5, & 2, & 1, & 3, & 7, & 7 \\ \hline & 1, & 5, & 2, & 1, & 3, & 1, & 1 \end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 3 \times 3 \times 7 \times 5 \times 2 \times 3$
$= 22680.$

(20)
$$\begin{array}{r|rrrrr} 3 & 225, & 255, & 289, & 1023, & 4095 \\ \hline 3 & 75, & 85, & 289, & 341, & 1365 \\ \hline 5 & 25, & 85, & 289, & 341, & 455 \\ \hline 5 & 5, & 17, & 289, & 341, & 91 \\ \hline 7 & 1, & 17, & 289, & 341, & 91 \\ \hline 13 & 1, & 17, & 289, & 341, & 13 \\ \hline 17 & 1, & 17, & 289, & 341, & 1 \\ \hline & 1, & 1, & 17, & 341, & 1 \end{array}$$

$\therefore$ L. C. M. $= 3 \times 3 \times 5 \times 5 \times 7 \times 13 \times 17 \times 17 \times 341$
$= 2017790775.$

MISCELLANEOUS QUESTIONS.

Ex. IX. (p. 31.)

I.

(1)
$$\begin{array}{r} 603\\ 48\\ \hline 4824\\ 2412\\ \hline 28944\\ \hline \end{array}$$

(2) Nine millions, ninety thousand, nine hundred and nine.
Ninety thousand, nine hundred and nine.

$$\begin{array}{r} 9090909\\ 90909\\ \hline 9181818\\ \hline \end{array} \qquad\qquad \begin{array}{r} 9090909\\ 90909\\ \hline 9000000\\ \hline \end{array}$$

(3)
$$\begin{array}{r} 4715\\ 398\\ \hline 37720\\ 42435\\ 14145\\ \hline 1876570\\ \hline \end{array} \qquad\qquad \begin{array}{r} 2017\\ 408\\ \hline 16136\\ 8068\\ \hline 822936\\ \hline \end{array} \qquad\qquad \begin{array}{r} 1876570\\ 822936\\ \hline 1053634\\ \hline \end{array}$$

(4) Son's age $= 73$ years $- 37$ years
$= 36$ years.

(5)
$$\begin{aligned} &15 \times 37153 - 73474 - 67152 \div 4 + 40734 \times 2\\ &= 557295 - 73474 - 16788 + 81468\\ &= 483821 - 16788 + 81468\\ &= 467033 + 81468\\ &= 548501. \end{aligned}$$

II.

(2)
$$\begin{array}{r} 45\,)\,18675\,(415\\ 180\\ \hline 67\\ 45\\ \hline 225\\ 225\\ \hline \end{array} \qquad\qquad \begin{array}{r} 5,0\,)\,\underline{7925,0}\\ 1585\\ \hline \end{array}$$

∴ in one year the deaths amount to
$415 + 1585 = 2000$;
∴ n°. of years required $= 10000 \div 2000$
$= 5$.

(3) 700409000000000000.

(4) Since

$$\begin{aligned} 494871-94853&=400018,\\ 45079-\ 3177&=\ 41902,\\ 54312-\ 3987&=\ 50325,\\ 1763+\ 231&=\ 1994,\\ 379\times\ 379&=143641, \end{aligned}$$

the expression is equal to

$$\begin{aligned} &400018+41902-50325-1994+143641\\ &=441920-50325-1994+143641\\ &=391595-1994+143641\\ &=389601+143641\\ &=533242. \end{aligned}$$

(5) Number required $=528\times 36+44$

$$\begin{aligned} &=19008+44\\ &=19052. \end{aligned}$$

III.

(2)

$$\begin{array}{r@{}l} & 15683\\ & \underline{\ \ 9892}\\ 85) & 25575\ (300\\ & \underline{255}\\ & \underline{\ \ \ 75} \end{array}$$

∴ number of days $=300$, and there will be 75 lines remaining.

(3)

$$\begin{array}{r|l} 2 & \underline{12,\ 16,\ 21,\ 52,\ 70}\\ 2 & \underline{\ 6,\ \ 8,\ 21,\ 26,\ 35}\\ 3 & \underline{\ 3,\ \ 4,\ 21,\ 13,\ 35}\\ 7 & \underline{\ 1,\ \ 4,\ \ 7,\ 13,\ 35}\\ & \ 1,\ \ 4,\ \ 1,\ 13,\ \ 5 \end{array}$$

∴ L. C. M. $=2\times 2\times 3\times 7\times 4\times 13\times 5$

$=21840.$

(4) $(7854-4913)\times 3=2941\times 3=8823,$

$(20374-12530)\div 53=7844\div 53=148,$

$(395456-2364)\div 556=393092\div 556=707;$

∴ the expression is equal to

$$\begin{aligned} &8823-148-6+707\\ &=8675-6+707\\ &=8669+707\\ &=9376. \end{aligned}$$

(5) *A, B* and *C* score 108 runs,
B and *C* " 90 runs,
A and *C* " 51 runs;

∴ *A* scores (108—90) runs = 18 runs,
B " (108—51) runs = 57 runs;

∴ *A* and *B* score (18 + 57) runs = 75 runs,

∴ *C* scores (108—75) runs = 33 runs.

IV.

(1) *Ans.* 24570.

(2) The smaller = 373625 ÷ 875
= 427;

∴ sum of numbers = 875 + 427 = 1302,
difference = 875 — 427 = 448.

(3) Son's age will be (50—21) years = 29 years,
Father's " " (50 + 21) years = 71 years.

(4) 100100101;
One thousand and ten millions, one hundred and one thousand and ten;

1840.

(5)
$$\begin{array}{l} 849)\,1132\,(1 \\ \underline{849} \\ 283)\,849\,(3 \\ \underline{849} \end{array}$$

∴ 283 is the G. C. M.,

and L. C. M. $= \frac{849 \times 1132}{283} = \frac{961068}{288} = 3396.$

V.

(1)
$$\begin{array}{r} 478 \\ \underline{146} \\ 2868 \\ 1912 \\ \underline{478} \\ \underline{69788} \end{array} \qquad \begin{array}{l} 99)\,4843\,(48 \\ \underline{396} \\ 883 \\ \underline{792} \\ \underline{91} \end{array}$$

(2) Number = 163 × 430 ÷ 86
= 70090 ÷ 86
= 815

(3) In each 12 persons, 2 speak German, 3 speak Tschech, and 7 speak German and Tschech;

∴ in 120000 persons,
20000 speak German,
30000 " Tschech,
70000 " German and Tschech.

(4) His property $= £(10000 + 15000 + 5500 \times 4 + 3750 \times 3 + 4563 + 599)$
$= £(10000 + 15000 + 22000 + 11250 + 4563 + 599)$
$= £63412$.

(5) Divisor $= (9281 - 373) \div 17$
$= 8908 \div 17$
$= 524$.

VI.

(1) MDLXIII. and $\overline{\text{IX}}$.

(3) Divisor $= 97 + 665 + 91 = 853$;

∴ dividend $= 853 \times 665 + 97$
$= 567245 + 97$
$= 567342$.

(4) Two hundred and seventy thousand, one hundred and thirty; twenty-six thousand, seven hundred and eighty-four; 10234.

$$8\,\underline{)\,10234}$$
$$\underline{1279} - 2 \text{ remainder};$$

∴ 6 is the number required.

(5) Two years since eldest son's age $= \frac{58}{2} = 29$;

∴ eldest son's age now $= 31$,

youngest son's age $= \frac{60 + 31}{7} = \frac{91}{7} = 13$,

daughter's age $= 60 - (31 + 13)$
$= 60 - 44$
$= 16$.

VULGAR FRACTIONS.

Ex. X. (p. 36.)

(1) $\frac{5}{12} \times 3 = \frac{15}{12}$; $\frac{5}{12} \times 9 = \frac{45}{12}$; $\frac{5}{12} \times 12 = \frac{60}{12}$; $\frac{5}{12} \times 36 = \frac{180}{12}$.

(2) $\frac{41}{63} \times 7 = \frac{287}{63}$; $\frac{41}{63} \times 15 = \frac{615}{63}$; $\frac{41}{63} \times 21 = \frac{861}{63}$; $\frac{41}{63} \times 45 = \frac{1845}{63}$.

Ex. XI. (p. 36.)

(1) $\frac{5}{8} \div 2 = \frac{5}{8 \times 2} = \frac{5}{16}$; $\frac{5}{8} \div 3 = \frac{5}{8 \times 3} = \frac{5}{24}$; $\frac{5}{8} \div 4 = \frac{5}{8 \times 4} = \frac{5}{32}$;

$\frac{5}{8} \div 5 = \frac{5}{8 \times 5} = \frac{5}{40}$; $\frac{5}{8} \div 10 = \frac{5}{8 \times 10} = \frac{5}{80}$.

(2) $\frac{15}{587} \div 11 = \frac{15}{587 \times 11} = \frac{15}{6457}$; $\frac{15}{587} \div 20 = \frac{15}{587 \times 20} = \frac{15}{11740}$;

$\frac{15}{587} \div 25 = \frac{15}{587 \times 25} = \frac{15}{14675}$; $\frac{15}{587} \div 45 = \frac{15}{587 \times 45} = \frac{15}{26415}$.

Ex. XII. (p. 37.)

(1) $7 = \frac{7}{1} = \frac{7 \times 3}{1 \times 3} = \frac{21}{3}$; $7 = \frac{7}{1} = \frac{7 \times 7}{1 \times 7} = \frac{49}{7}$; $7 = \frac{7}{1} = \frac{7 \times 22}{1 \times 22} = \frac{154}{22}$;

$9 = \frac{9}{1} = \frac{9 \times 3}{1 \times 3} = \frac{27}{3}$; $9 = \frac{9}{1} = \frac{9 \times 7}{1 \times 7} = \frac{63}{7}$; $9 = \frac{9}{1} = \frac{9 \times 22}{1 \times 22} = \frac{198}{22}$;

$11 = \frac{11}{1} = \frac{11 \times 3}{1 \times 3} = \frac{33}{3}$; $11 = \frac{11}{1} = \frac{11 \times 7}{1 \times 7} = \frac{77}{7}$;

$11 = \frac{11}{1} = \frac{11 \times 22}{1 \times 22} = \frac{242}{22}$.

(2) $26 = \frac{26}{1} = \frac{26 \times 2}{1 \times 2} = \frac{52}{2}$; $26 = \frac{26}{1} = \frac{26 \times 5}{1 \times 5} = \frac{130}{5}$;

$26 = \frac{26}{1} = \frac{26 \times 13}{1 \times 13} = \frac{338}{13}$; $26 = \frac{26}{1} = \frac{26 \times 23}{1 \times 23} = \frac{598}{23}$;

$26 = \frac{26}{1} = \frac{26 \times 35}{1 \times 35} = \frac{910}{35}$;

$$109=\frac{109}{1}=\frac{109\times2}{1\times2}=\frac{218}{2};\quad 109=\frac{109}{1}=\frac{109\times5}{1\times5}=\frac{545}{5};$$

$$109=\frac{109}{1}=\frac{109\times13}{1\times13}=\frac{1417}{13};\quad 109=\frac{109}{1}=\frac{109\times23}{1\times23}=\frac{2507}{23};$$

$$109=\frac{109}{1}=\frac{109\times35}{1\times35}=\frac{3815}{35};$$

$$117=\frac{117}{1}=\frac{117\times2}{1\times2}=\frac{234}{2};\quad 117=\frac{117}{1}=\frac{117\times5}{1\times5}=\frac{585}{5};$$

$$117=\frac{117}{1}=\frac{117\times13}{1\times13}=\frac{1521}{13};\quad 117=\frac{117}{1}=\frac{117\times23}{1\times23}=\frac{2691}{23};$$

$$117=\frac{117}{1}=\frac{117\times35}{1\times35}=\frac{4095}{35};$$

$$125=\frac{125}{1}=\frac{125\times2}{1\times2}=\frac{250}{2};\quad 125=\frac{125}{1}=\frac{125\times5}{1\times5}=\frac{625}{5};$$

$$125=\frac{125}{1}=\frac{125\times13}{1\times13}=\frac{1625}{13};\quad 125=\frac{125}{1}=\frac{125\times23}{1\times23}=\frac{2875}{23};$$

$$125=\frac{125}{1}=\frac{125\times35}{1\times35}=\frac{4375}{35}.$$

Ex. XIII. (p. 38.)

(1) $\frac{15}{4}=3\frac{3}{4}$. (2) $\frac{77}{6}=12\frac{5}{6}$. (3) $\frac{49}{8}=6\frac{1}{8}$. (4) $\frac{113}{9}=12\frac{5}{9}$.

(5) $\frac{63}{7}=9$. (6) $\frac{443}{12}=36\frac{11}{12}$. (7) $\frac{587}{13}=45\frac{2}{13}$.

(8) $\frac{183}{55}=3\frac{18}{55}$. (9) $\frac{751}{24}=31\frac{7}{24}$. (10) $\frac{5801}{63}=92\frac{5}{63}$.

(11) $\frac{648}{108}=6$. (12) $\frac{5876}{157}=37\frac{67}{157}$. (13) $\frac{10000}{111}=90\frac{10}{111}$.

(14) $\frac{231750}{153}=1514\frac{108}{153}$. (15) $\frac{14264}{239}=59\frac{163}{239}$. (16) $\frac{95950}{999}=96\frac{46}{999}$.

(17) $\frac{25713}{1168}=22\frac{17}{1168}$. (18) $\frac{632625}{1741}=363\frac{642}{1741}$.

(19) $\frac{978911}{36425}=26\frac{31861}{36425}$. (20) $\frac{46325}{3724}=12\frac{1637}{3724}$.

Ex. XIV. (p. 39.)

(1) $2\frac{1}{3}=\frac{2\times3+1}{3}=\frac{7}{3}$. (2) $5\frac{3}{7}=\frac{5\times7+3}{7}=\frac{38}{7}$.

(3) $4\frac{5}{9}=\frac{4\times9+5}{9}=\frac{41}{9}$. (4) $7\frac{2}{5}=\frac{7\times5+2}{5}=\frac{37}{5}$.

(5) $25\frac{11}{12}=\frac{25\times12+11}{12}=\frac{311}{12}$. (6) $43\frac{7}{11}=\frac{43\times11+7}{11}=\frac{480}{11}$.

(7) $25\frac{1}{13}=\frac{25\times13+1}{19}=\frac{325+1}{13}=\frac{326}{13}$.

(8) $14\frac{13}{15}=\frac{14\times15+13}{15}=\frac{210+13}{15}=\frac{223}{15}$.

(9) $2003\frac{1}{7}=\frac{2003\times7+1}{7}=\frac{14021+1}{7}=\frac{14022}{7}$.

(10) $857\frac{11}{13}=\frac{857\times13+11}{13}=\frac{11141+11}{13}=\frac{11152}{13}$.

(11) $57\frac{31}{43}=\frac{57\times43+31}{43}=\frac{2451+\quad}{43}=\frac{2482}{43}$.

(12) $13\frac{83}{84}=\frac{13\times84+83}{84}=\frac{1092+83}{84}=\frac{1175}{84}$.

(13) $3\frac{95}{224}=\frac{3\times224+95}{224}=\frac{672+95}{224}=\frac{767}{224}$.

(14) $26\frac{201}{202}=\frac{26\times202+201}{202}=\frac{5252+201}{202}=\frac{5453}{202}$.

(15) $164\frac{118}{441}=\frac{164\times441+118}{441}=\frac{72324+118}{441}=\frac{72442}{441}$.

(16) $106\frac{119}{851}=\frac{106\times851+119}{851}=\frac{90206+119}{851}=\frac{90325}{851}$.

(17) $157\frac{122}{137}=\frac{157\times137+122}{137}=\frac{21509+122}{137}=\frac{21631}{137}$.

(18) $17\frac{2605}{2859}=\frac{17\times2859+2605}{2859}=\frac{48603+2605}{2859}=\frac{51208}{2859}$.

(19) $427\frac{5}{1107}=\frac{427\times1107+5}{1107}=\frac{472689+5}{1107}=\frac{472694}{1107}$.

(20) $100\frac{413}{720}=\frac{100\times720+413}{720}=\frac{72000+413}{720}=\frac{72413}{720}$.

Ex. XV. (p. 40.)

Note.—In the following Examples, common factors are stuck out of numerator and denominator.

(1) $\frac{2}{3}$ of $\frac{4}{5}=\frac{2\times4}{3\times5}=\frac{8}{15}$. (2) $\frac{6}{7}$ of $\frac{9}{10}=\frac{6\times9}{7\times10}=\frac{2\times3\times9}{7\times2\times5}=\frac{27}{35}$.

(3) $\frac{2}{5}$ of $\frac{3}{4}=\frac{2\times3}{5\times4}=\frac{2\times3}{5\times2\times2}=\frac{3}{10}$. (4) $\frac{5}{6}$ of $\frac{11}{12}=\frac{5\times11}{6\times12}=\frac{55}{72}$.

(5) $\frac{7}{8}$ of $\frac{5}{6}$ of $7=\frac{7\times5\times7}{8\times6}=\frac{245}{48}$.

(6) $\frac{5}{8}$ of $\frac{3}{7}$ of $\frac{2}{3}$ of $\frac{1}{15}$ of $28=\frac{5\times3\times2\times28}{8\times7\times3\times15}=\frac{5\times3\times2\times4\times7}{2\times4\times7\times3\times5\times3}=\frac{1}{3}$.

(7) $\frac{5}{11}$ of $2\frac{1}{2}$ of $\frac{5}{7}$ of $10\frac{1}{2}=\frac{5}{11}$ of $\frac{5}{2}$ of $\frac{5}{7}$ of $\frac{21}{2}=\frac{5\times5\times5\times3\times7}{11\times2\times7\times2}=\frac{375}{44}$.

(8) $\frac{7}{9}$ of $12\frac{1}{2}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{3}{8}$ of 9

$=\frac{7}{9}$ of $\frac{25}{2}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{3}{8}$ of $9=\frac{7\times25\times4\times5\times3\times9}{9\times2\times5\times2\times3\times2\times4}=\frac{175}{8}$.

(9) $\frac{5}{18}$ of $\frac{7}{3}$ of $\frac{36}{10}$ of $\frac{9}{4}$ of $\frac{3}{10}$ of 2 of $\frac{8}{27}$

$=\frac{5\times7\times36\times9\times3\times2\times8}{18\times3\times10\times4\times10\times27}$

$=\frac{5\times7\times18\times2\times9\times3\times2\times4\times2}{18\times3\times5\times2\times4\times5\times2\times3\times9}$

$=\frac{14}{15}$.

(10) $\frac{5}{7}$ of $\frac{3}{8}$ of $\frac{6}{7}$ of $70\frac{2}{9}$ of $\frac{3}{40}$ of $1\frac{7}{11}$ of 147

$=\frac{5}{7}$ of $\frac{3}{8}$ of $\frac{6}{7}$ of $\frac{632}{9}$ of $\frac{3}{40}$ of $\frac{18}{11}$ of 147

$=\frac{5\times3\times6\times632\times3\times18\times147}{7\times8\times7\times9\times40\times11}$

$=\frac{5\times3\times2\times3\times8\times79\times3\times9\times2\times7\times7\times3}{7\times2\times2\times2\times7\times9\times8\times5\times11}$

$=\frac{3\times3\times79\times3\times3}{2\times11}$

$=\frac{6399}{22}$.

Ex. XVI. (p. 41.)

In each of the following Examples we divide numerator and denominator by their G. C. M.

Thus in (1) $\frac{4}{8}=\frac{4}{4\times2}=\frac{1}{2}$ (dividing by 4, the G.C.M.);

or, as we shall write it in the following Examples,

$$\frac{4}{8}=\frac{4\div4}{8\div4}=\frac{1}{2}.$$

(2) $\frac{10}{15}=\frac{10\div5}{15\div5}=\frac{2}{3}$.

(3) $\frac{14}{21}=\frac{14\div7}{21\div7}=\frac{2}{3}$.

(4) $\frac{18}{45}=\frac{18\div9}{45\div9}=\frac{2}{5}$.

(5) $\frac{56}{63}=\frac{56\div7}{63\div7}=\frac{8}{9}$.

(6) $\frac{54}{81}=\frac{54\div27}{81\div27}=\frac{2}{3}$.

(7) $\frac{63}{135}=\frac{63\div9}{135\div9}=\frac{7}{15}$.

(8) $\frac{66}{121}=\frac{66\div11}{121\div11}=\frac{6}{11}$.

(9) $\frac{246}{342}=\frac{246\div6}{342\div6}=\frac{41}{57}$.

(10) $\frac{247}{323}=\frac{247\div19}{323\div19}=\frac{13}{17}$.

(11) $\frac{272}{425}=\frac{272\div17}{425\div17}=\frac{16}{25}$.

(12) $\frac{330}{726}=\frac{330\div66}{726\div66}=\frac{5}{11}$.

(13) $\frac{825}{2709}=\frac{825\div3}{2709\div3}=\frac{275}{903}$.

(14) $\frac{630}{936}=\frac{630\div18}{936\div18}=\frac{35}{52}$.

(15) $\frac{324}{612}=\frac{324\div36}{612\div36}=\frac{9}{17}$.

(16) $\frac{936}{2368}=\frac{936\div8}{2368\div8}=\frac{117}{296}$.

(17) $\frac{5184}{6912}=\frac{5184\div1728}{6912\div1728}=\frac{3}{4}$.

(18) $\frac{3444}{3556}=\frac{3444\div28}{3556\div28}=\frac{123}{127}$.

(19) $\frac{7845}{96780}=\frac{7845\div15}{96780\div15}=\frac{523}{6452}$.

(20) $\frac{2472}{3264}=\frac{2472\div24}{3264\div24}=\frac{103}{136}$.

(21) $\frac{625}{9000}=\frac{625\div125}{9000\div125}=\frac{5}{72}$.

(22) $\frac{81}{4872}=\frac{81\div3}{4872\div3}=\frac{27}{1624}$.

(23) $\frac{1632}{2976}=\frac{1632\div96}{2976\div96}=\frac{17}{31}$.

(24) $\frac{10265}{14371}=\frac{10265\div2053}{14371\div2053}=\frac{5}{7}$.

(25) $\frac{4301}{95897}=\frac{4301\div17}{95897\div17}=\frac{253}{5641}$.

(26) $\frac{55247}{74841}=\frac{55247\div101}{74841\div101}=\frac{547}{741}$.

(27) $\frac{6093}{9174}=\frac{6093\div3}{9174\div3}=\frac{2031}{3058}$.

(28) $\frac{10812}{22800}=\frac{10812\div12}{22800\div12}=\frac{901}{1900}$.

(29) $\frac{25194}{88179}=\frac{25194\div 12597}{88179\div 12597}=\frac{2}{7}.$

(30) $\frac{374192}{575680}=\frac{374192\div 28784}{575680\div 28784}=\frac{13}{20}.$

(31) $\frac{114135}{220661}=\frac{114135\div 7609}{220661\div 7609}=\frac{15}{29}.$

(32) $\frac{128352}{238368}=\frac{128352\div 18336}{238368\div 18336}=\frac{7}{13}.$

Ex. XVII. (p. 43.)

(1) $\frac{1}{2}, \frac{2}{3}, \frac{4}{5}.$ 30 is L.C.M. of denominators;

∴ fractions become $\frac{1\times 15}{2\times 15}, \frac{2\times 10}{3\times 10}, \frac{4\times 6}{5\times 6},$ or $\frac{15}{30}, \frac{20}{30}, \frac{24}{30}.$

(2) $\frac{2}{5}, \frac{7}{8}.$ 40 is L.C.M. of denominators;

∴ fractions become $\frac{2\times 8}{5\times 8}, \frac{7\times 5}{8\times 5},$ or $\frac{16}{40}, \frac{35}{40}.$

(3) $\frac{2}{3}, \frac{3}{4}, \frac{5}{6}.$ 12 is L.C.M. of denominators;

∴ fractions become $\frac{2\times 4}{3\times 4}, \frac{3\times 3}{4\times 3}, \frac{5\times 2}{6\times 2},$ or $\frac{8}{12}, \frac{9}{12}, \frac{10}{12}.$

(4) $\frac{2}{9}, \frac{5}{27}.$ 27 is L.C.M. of denominators;

∴ fractions become $\frac{2\times 3}{9\times 3}, \frac{5}{27},$ or $\frac{6}{27}, \frac{5}{27}.$

(5) $\frac{3}{7}, \frac{5}{14}, \frac{11}{28}.$ 28 is L.C.M. of denominators;

∴ fractions become $\frac{3\times 4}{7\times 4}, \frac{5\times 2}{14\times 2}, \frac{11}{28},$ or $\frac{12}{28}, \frac{10}{28}, \frac{11}{28}.$

(6) $\frac{1}{2}, \frac{3}{4}, \frac{5}{9}.$ 36 is L.C.M. of denominators;

∴ fractions become $\frac{1\times 18}{2\times 18}, \frac{3\times 9}{4\times 9}, \frac{5\times 4}{9\times 4},$ or $\frac{18}{36}, \frac{27}{36}, \frac{20}{36}.$

(7) $\frac{7}{8}, \frac{11}{12}, \frac{17}{18}$. 72 is L. C. M. of denominators;

∴ fractions become

$$\frac{7\times 9}{8\times 9}, \frac{11\times 6}{12\times 6}, \frac{17\times 4}{18\times 4}, \text{ or } \frac{63}{72}, \frac{66}{72}, \frac{68}{72}.$$

(8) $\frac{5}{12}, \frac{7}{16}, \frac{13}{24}$. 48 is L. C. M. of denominators;

∴ fractions become

$$\frac{5\times 4}{12\times 4}, \frac{7\times 3}{16\times 3}, \frac{13\times 2}{24\times 2}, \text{ or } \frac{20}{48}, \frac{21}{48}, \frac{26}{48}.$$

(9) $\frac{5}{6}, \frac{9}{10}, \frac{14}{15}$. 30 is L. C. M. of denominators;

∴ fractions become

$$\frac{5\times 5}{6\times 5}, \frac{9\times 3}{10\times 3}, \frac{14\times 2}{15\times 2}, \text{ or } \frac{25}{30}, \frac{27}{30}, \frac{28}{30}.$$

(10) $\frac{2}{5}, \frac{2}{3}, \frac{5}{9}, \frac{7}{10}$. 90 is L. C. M. of denominators;

∴ fractions become

$$\frac{2\times 18}{5\times 18}, \frac{2\times 30}{3\times 30}, \frac{5\times 10}{9\times 10}, \frac{7\times 9}{10\times 9}, \text{ or } \frac{36}{90}, \frac{60}{90}, \frac{50}{90}, \frac{63}{90}.$$

(11) $\frac{2}{3}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}$. 24 is L. C. M. of denominators;

∴ fractions become

$$\frac{2\times 8}{3\times 8}, \frac{3\times 6}{4\times 6}, \frac{5\times 4}{6\times 4}, \frac{7\times 3}{8\times 3}, \text{ or } \frac{16}{24}, \frac{18}{24}, \frac{20}{24}, \frac{21}{24}.$$

(12) $\frac{1}{7}, \frac{4}{11}, \frac{7}{13}, \frac{2}{3}$. 3003 is L. C. M. of denominators;

∴ fractions become

$$\frac{1\times 429}{7\times 429}, \frac{4\times 273}{11\times 273}, \frac{7\times 231}{13\times 231}, \frac{2\times 1001}{3\times 1001}, \text{ or } \frac{429}{3003}, \frac{1092}{3003}, \frac{1617}{3003}, \frac{2002}{3003}.$$

(13) $\frac{3}{5}, \frac{35}{80}, \frac{14}{200}$. 400 is L. C. M. of denominators;

∴ fractions become

$$\frac{3\times 80}{5\times 80}, \frac{35\times 5}{80\times 5}, \frac{14\times 2}{200\times 2}, \text{ or } \frac{240}{400}, \frac{175}{400}, \frac{28}{400}.$$

(14) $\frac{7}{12}, \frac{6}{7}, \frac{20}{63}, \frac{13}{84}.$ 252 is L. C. M. of denominators;

∴ fractions become

$$\frac{7\times21}{12\times21}, \frac{6\times36}{7\times36}, \frac{20\times4}{63\times4}, \frac{13\times3}{84\times3}, \text{ or } \frac{147}{252}, \frac{216}{252}, \frac{80}{252}, \frac{39}{252}.$$

(15) $\frac{7}{9}, \frac{5}{11}, \frac{13}{18}, \frac{3}{22}, \frac{1}{36}.$ 396 is L. C. M. of denominators;

∴ fractions become

$$\frac{7\times44}{9\times44}, \frac{5\times36}{11\times36}, \frac{13\times22}{18\times22}, \frac{3\times18}{22\times18}, \frac{1\times11}{36\times11},$$

$$\text{or } \frac{308}{396}, \frac{180}{396}, \frac{286}{396}, \frac{54}{396}, \frac{11}{396}.$$

(16) $\frac{1}{3}, \frac{7}{8}, \frac{5}{6}, \frac{9}{14}, \frac{3}{28}, \frac{17}{32}.$ 672 is L. C. M. of denominators;

∴ fractions become

$$\frac{1\times224}{3\times224}, \frac{7\times84}{8\times84}, \frac{5\times112}{6\times112}, \frac{9\times48}{14\times48}, \frac{3\times24}{28\times24}, \frac{17\times21}{32\times21},$$

$$\text{or } \frac{224}{672}, \frac{588}{672}, \frac{560}{672}, \frac{432}{672}, \frac{72}{672}, \frac{357}{672}.$$

(17) $\frac{2}{3}, \frac{4}{9}, \frac{7}{27}, \frac{8}{81}, \frac{16}{243}, \frac{31}{729}.$ 729 is L. C. M. of denominators;

∴ fractions become

$$\frac{2\times243}{3\times243}, \frac{4\times81}{9\times81}, \frac{7\times27}{27\times27}, \frac{8\times9}{81\times9}, \frac{16\times3}{243\times3}, \frac{31}{729},$$

$$\text{or } \frac{486}{729}, \frac{324}{729}, \frac{189}{729}, \frac{72}{729}, \frac{48}{729}, \frac{31}{729}.$$

(18) $\frac{9}{10}, \frac{9}{100}, \frac{9}{1000}, \frac{9}{10000}.$ 10000 is L. C. M. of denominators;

∴ fractions become

$$\frac{9\times1000}{10\times1000}, \frac{9\times100}{100\times100}, \frac{9\times10}{1000\times10}, \frac{9}{10000},$$

$$\text{or } \frac{9000}{10000}, \frac{900}{10000}, \frac{90}{10000}, \frac{9}{10000}.$$

(19) $\frac{31}{60}, \frac{17}{90}, \frac{13}{25}, \frac{1}{105}, \frac{5}{9}$. 6300 is L. C. M. of denominators;

∴ fractions become

$$\frac{31 \times 105}{60 \times 105}, \frac{17 \times 70}{90 \times 70}, \frac{13 \times 252}{25 \times 252}, \frac{1 \times 60}{105 \times 60}, \frac{5 \times 700}{9 \times 700},$$

$$\text{or } \frac{3255}{6300}, \frac{1190}{6300}, \frac{3276}{6300}, \frac{60}{6300}, \frac{3500}{6300}.$$

(20) $\frac{31}{54}, \frac{11}{28}, \frac{53}{63}, \frac{3}{12}$. 756 is L. C. M. of denominators;

∴ fractions become

$$\frac{31 \times 14}{54 \times 14}, \frac{11 \times 27}{28 \times 27}, \frac{53 \times 12}{63 \times 12}, \frac{3 \times 63}{12 \times 63}, \text{ or } \frac{434}{756}, \frac{297}{756}, \frac{636}{756}, \frac{189}{756}.$$

Ex. XVIII. (p. 45.)

1. (1) $\frac{3}{5}, \frac{8}{9}, \frac{7}{10}$. 90 is L. C. M. of denominators;

∴ fractions become

$$\frac{3 \times 18}{5 \times 18}, \frac{8 \times 10}{9 \times 10}, \frac{7 \times 9}{10 \times 9}, \text{ or } \frac{54}{90}, \frac{80}{90}, \frac{63}{90};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{8}{9}, \frac{7}{10}, \frac{3}{5}.$$

(2) $\frac{1}{2}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}$. 24 is L. C. M. of denominators;

∴ fractions become

$$\frac{1 \times 12}{2 \times 12}, \frac{3 \times 6}{4 \times 6}, \frac{5 \times 4}{6 \times 4}, \frac{7 \times 3}{8 \times 3}, \text{ or } \frac{12}{24}, \frac{18}{24}, \frac{20}{24}, \frac{21}{24};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{7}{8}, \frac{5}{6}, \frac{3}{4}, \frac{1}{2}.$$

(3) $\frac{1}{5}$ of $\frac{3}{8}$, $\frac{7}{12}$, $\frac{4}{3}$ of $\frac{6}{7}$, or $\frac{3}{40}, \frac{7}{12}, \frac{8}{7}$. 840 is L. C. M. of dens;

∴ fractions become

$$\frac{3 \times 21}{40 \times 21}, \frac{7 \times 70}{12 \times 70}, \frac{8 \times 120}{7 \times 120}, \text{ or } \frac{63}{840}, \frac{490}{840}, \frac{960}{840};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{4}{3} \text{ of } \frac{6}{7}, \frac{7}{12}, \frac{1}{5} \text{ of } \frac{3}{8}.$$

(4) $\frac{5}{12}, \frac{3}{16}, \frac{10}{21}, \frac{31}{60}$. 1680 is L. C. M. of denominators;

∴ fractions become

$$\frac{5\times140}{12\times140}, \frac{3\times105}{16\times105}, \frac{10\times80}{21\times80}, \frac{31\times28}{60\times28}, \text{ or } \frac{700}{1680}, \frac{315}{1680}, \frac{800}{1680}, \frac{868}{1680};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{31}{60}, \frac{10}{21}, \frac{5}{12}, \frac{3}{16}.$$

(5) $\frac{3}{7}, \frac{7}{13}, \frac{9}{22}, \frac{8}{11}, \frac{21}{26}$. 2002 is L. C. M. of denominators;

∴ fractions become

$$\frac{3\times286}{7\times286}, \frac{7\times154}{13\times154}, \frac{9\times91}{22\times91}, \frac{8\times182}{11\times182}, \frac{21\times77}{26\times77},$$

$$\text{or } \frac{858}{2002}, \frac{1078}{2002}, \frac{819}{2002}, \frac{1456}{2002}, \frac{1617}{2002};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{21}{26}, \frac{8}{11}, \frac{7}{13}, \frac{3}{7}, \frac{9}{22}.$$

(6) $\frac{3}{7}$ of $\frac{5}{8}$ of 4, $\frac{2}{11}$ of $\frac{3}{5}$ of 5, $\frac{1}{6}$ of $\frac{1}{2}$ of $4\frac{3}{4}$, $\frac{14}{28}$, or $\frac{15}{14}, \frac{6}{11}, \frac{19}{48}, \frac{1}{2}$.

3696 is L.C.M. of denominators; ∴ fractions become

$$\frac{15\times264}{14\times264}, \frac{6\times336}{11\times336}, \frac{19\times77}{48\times77}, \frac{1\times1848}{2\times1848}, \text{ or } \frac{3960}{3696}, \frac{2016}{3696}, \frac{1463}{3696}, \frac{1848}{3696};$$

∴ in order of magnitude the fractions stand thus,

$\frac{3}{7}$ of $\frac{5}{8}$ of 4, $\frac{2}{11}$ of $\frac{3}{5}$ of 5, $\frac{14}{28}$, $\frac{1}{6}$ of $\frac{1}{2}$ of $4\frac{3}{4}$.

(7) $\frac{3}{8}, \frac{27}{32}, \frac{9}{16}, \frac{7}{10}, \frac{27}{40}$. 160 is L. C. M. of denominators;

∴ fractions become

$$\frac{3\times20}{8\times20}, \frac{27\times5}{32\times5}, \frac{9\times10}{16\times10}, \frac{7\times16}{10\times16}, \frac{27\times4}{40\times4},$$

$$\text{or } \frac{60}{160}, \frac{135}{160}, \frac{90}{160}, \frac{112}{160}, \frac{108}{160};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{27}{32}, \frac{7}{10}, \frac{27}{40}, \frac{9}{16}, \frac{3}{8}.$$

(8) $\frac{15}{4}$, $3\frac{1}{3}$, $\frac{2}{7}$ of $9\frac{2}{5}$, or $\frac{15}{4}$, $\frac{10}{3}$, $\frac{94}{35}$.

420 is L. C. M. of denominators; ∴ fractions become

$$\frac{15\times105}{4\times105},\ \frac{10\times140}{3\times140},\ \frac{94\times12}{35\times12},\ \text{or}\ \frac{1575}{420},\ \frac{1400}{420},\ \frac{1128}{420};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{15}{4},\ 3\frac{1}{3},\ \frac{2}{7}\text{ of }9\frac{2}{5}.$$

(9) $\frac{6}{7}$, $\frac{13}{28}$, $1\frac{4}{9}$, $\frac{5}{8}$, $\frac{29}{56}$, or $\frac{6}{7}$, $\frac{13}{28}$, $\frac{13}{9}$, $\frac{5}{8}$, $\frac{29}{56}$.

504 is L. C. M. of denominators; ∴ fractions become

$$\frac{6\times72}{7\times72},\ \frac{13\times18}{28\times18},\ \frac{13\times56}{9\times56},\ \frac{5\times63}{8\times63},\ \frac{29\times9}{56\times9},$$

$$\text{or}\ \frac{432}{504},\ \frac{234}{504},\ \frac{728}{504},\ \frac{315}{504},\ \frac{261}{504};$$

∴ in order of magnitude the fractions stand thus,

$$1\frac{4}{9},\ \frac{6}{7},\ \frac{5}{8},\ \frac{29}{56},\ \frac{13}{28}.$$

(10) $\frac{8}{9}$, $\frac{3}{11}$, $\frac{7}{18}$, $\frac{9}{22}$, $\frac{5}{36}$. 396 is L. C. M. of denominators;

∴ fractions become

$$\frac{8\times44}{9\times44},\ \frac{3\times36}{11\times36},\ \frac{7\times22}{18\times22},\ \frac{9\times18}{22\times18},\ \frac{5\times11}{36\times11},$$

$$\text{or}\ \frac{352}{396},\ \frac{108}{396},\ \frac{154}{396},\ \frac{162}{396},\ \frac{55}{396};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{8}{9},\ \frac{9}{22},\ \frac{7}{18},\ \frac{3}{11},\ \frac{5}{36}.$$

(11) $\frac{51}{76}$, $\frac{113}{152}$, $1\frac{1}{38}$, $\frac{401}{448}$, $\frac{700}{748}$, or $\frac{51}{76}$, $\frac{113}{152}$, $\frac{39}{38}$, $\frac{401}{448}$, $\frac{700}{748}$.

1591744 is L. C. M. of denominators; ∴ fractions become

$$\frac{51\times20944}{76\times20944},\ \frac{113\times10472}{152\times10472},\ \frac{39\times41888}{38\times41888},\ \frac{401\times3553}{448\times3553},\ \frac{700\times2128}{748\times2128},$$

$$\text{or}\ \frac{1068144}{1591744},\ \frac{1183336}{1591744},\ \frac{1633632}{1591744},\ \frac{1424753}{1591744},\ \frac{1489600}{1591744};$$

∴ in order of magnitude the fractions stand thus,

$$1\frac{1}{38},\ \frac{700}{748},\ \frac{401}{448},\ \frac{113}{152},\ \frac{51}{76}.$$

(12) $\frac{15}{4}$, $3\frac{1}{3}$, $\frac{2}{7}$ of $9\frac{2}{5}$, $\frac{2}{7}$ of $\frac{5}{9}$ of $\frac{4}{5}$, or $\frac{15}{4}$, $\frac{10}{3}$, $\frac{94}{35}$, $\frac{8}{63}$.

1260 is L. C. M. of denominators; ∴ fractions become

$$\frac{15\times315}{4\times315},\ \frac{10\times420}{3\times420},\ \frac{94\times36}{35\times36},\ \frac{8\times20}{63\times20},$$

$$\text{or } \frac{4725}{1260},\ \frac{4200}{1260},\ \frac{3384}{1260},\ \frac{160}{1260},$$

∴ in order of magnitude the fractions stand thus,

$$\frac{15}{4},\ 3\tfrac{1}{3},\ \frac{2}{7} \text{ of } 9\tfrac{2}{5},\ \frac{2}{7} \text{ of } \frac{5}{9} \text{ of } \frac{4}{5}.$$

2. (1) $\frac{3}{4}$, $\frac{7}{12}$, $\frac{2}{3}$, $\frac{1}{6}$, and $\frac{1}{2}$. 12 is L. C. M. of denominators;

∴ fractions become

$$\frac{3\times3}{4\times3},\ \frac{7}{12},\ \frac{2\times4}{3\times4},\ \frac{1\times2}{6\times2},\ \frac{1\times6}{2\times6},\ \text{or } \frac{9}{12},\ \frac{7}{12},\ \frac{8}{12},\ \frac{2}{12},\ \frac{6}{12};$$

∴ $\frac{3}{4}$ is the greatest fraction and $\frac{1}{6}$ the least.

(2) $\frac{11}{12}$, $\frac{29}{30}$, $\frac{17}{18}$, $\frac{7}{16}$, $\frac{47}{48}$. 720 is L. C. M. of denominators;

∴ fractions become

$$\frac{11\times60}{12\times60},\ \frac{29\times24}{30\times24},\ \frac{17\times40}{18\times40},\ \frac{7\times45}{16\times45},\ \frac{47\times15}{48\times15},$$

$$\text{or } \frac{660}{720},\ \frac{696}{720},\ \frac{680}{720},\ \frac{315}{720},\ \frac{705}{720};$$

∴ $\frac{47}{48}$ is the greatest fraction and $\frac{7}{16}$ the least.

ADDITION OF VULGAR FRACTIONS.

Ex. XIX. (p. 47.)

1. (1) $\frac{2}{3}+\frac{5}{7}=\frac{2\times7}{3\times7}+\frac{5\times3}{7\times3}=\frac{14}{21}+\frac{15}{21}=\frac{29}{21}=1\frac{8}{21}$.

(2) $\frac{2}{9}+\frac{4}{9}=\frac{6}{9}=\frac{2}{3}$.

(3) $$\frac{5}{6}+\frac{7}{8}=\frac{5\times 4}{6\times 4}+\frac{7\times 3}{8\times 3}=\frac{20}{24}+\frac{21}{24}=\frac{41}{24}=1\tfrac{17}{24}.$$

(4) $$\frac{1}{7}+\frac{4}{21}=\frac{1\times 3}{7\times 3}+\frac{4}{21}=\frac{3}{21}+\frac{4}{21}=\frac{7}{21}=\frac{1}{3}.$$

(5) $$\frac{3}{16}+\frac{5}{64}=\frac{3\times 4}{16\times 4}+\frac{5}{64}=\frac{12}{64}+\frac{5}{64}=\frac{17}{64}.$$

(6) $$\frac{9}{14}+\frac{13}{21}=\frac{9\times 3}{14\times 3}+\frac{13\times 2}{21\times 2}=\frac{27}{42}+\frac{26}{42}=\frac{53}{42}=1\tfrac{11}{42}.$$

(7) $$\frac{5}{12}+\frac{7}{18}=\frac{5\times 3}{12\times 3}+\frac{7\times 2}{18\times 2}=\frac{15}{36}+\frac{14}{36}=\frac{29}{36}.$$

(8) $$\frac{3}{24}+\frac{21}{32}=\frac{1}{8}+\frac{21}{32}=\frac{1\times 4}{8\times 4}+\frac{21}{32}=\frac{4}{32}+\frac{21}{32}=\frac{25}{32}.$$

(9) $$\frac{3}{5}+2\tfrac{1}{6}=2+\frac{3}{5}+\frac{1}{6}=2+\frac{3\times 6}{5\times 6}+\frac{1\times 5}{6\times 5}=2+\frac{18}{30}+\frac{5}{30}=2\tfrac{23}{30}.$$

(10) $$\frac{5}{12}+\frac{7}{13}=\frac{5\times 13}{12\times 13}+\frac{7\times 12}{13\times 12}=\frac{65}{156}+\frac{84}{156}=\frac{149}{156}.$$

(11) $$3\tfrac{5}{8}+7\tfrac{2}{5}=10+\frac{5}{8}+\frac{2}{5}=10+\frac{5\times 5}{8\times 5}+\frac{2\times 8}{5\times 8}$$

$$=10+\frac{25}{40}+\frac{16}{40}=10+\frac{41}{40}=10+1\tfrac{1}{40}=11\tfrac{1}{40}.$$

(12) $$4\tfrac{3}{4}+9\tfrac{11}{12}=13+\frac{3}{4}+\frac{11}{12}=13+\frac{3\times 3}{4\times 3}+\frac{11}{12}=13+\frac{9}{12}+\frac{11}{12}$$

$$=13+\frac{20}{12}=13+1\tfrac{8}{12}=14\tfrac{2}{3}.$$

2. (1) $$\frac{2}{3}+\frac{5}{6}+\frac{7}{12}=\frac{2\times 4}{3\times 4}+\frac{5\times 2}{6\times 2}+\frac{7}{12}=\frac{8}{12}+\frac{10}{12}+\frac{7}{12}=\frac{25}{12}=2\tfrac{1}{12}.$$

(2) $$\frac{3}{5}+\frac{2}{7}+\frac{1}{3}=\frac{3\times 7\times 3}{5\times 7\times 3}+\frac{2\times 5\times 3}{7\times 5\times 3}+\frac{1\times 5\times 7}{3\times 5\times 7}$$

$$=\frac{63}{105}+\frac{30}{105}+\frac{35}{105}=\frac{128}{105}=1\tfrac{23}{105}.$$

(3) $$\frac{1}{2}+\frac{2}{5}+\frac{1}{10}=\frac{1\times 5}{2\times 5}+\frac{2\times 2}{5\times 2}+\frac{1}{10}=\frac{5}{10}+\frac{4}{10}+\frac{1}{10}=\frac{10}{10}=1.$$

(4) $$\frac{5}{12}+\frac{1}{8}+\frac{7}{24}=\frac{5\times 2}{12\times 2}+\frac{1\times 3}{8\times 3}+\frac{7}{24}=\frac{10}{24}+\frac{3}{24}+\frac{7}{24}=\frac{20}{24}=\frac{5}{6}.$$

(5) $\frac{2}{5}+\frac{3}{8}+\frac{7}{12}=\frac{2\times24}{5\times24}+\frac{3\times15}{8\times15}+\frac{7\times10}{12\times10}$

$=\frac{48}{120}+\frac{45}{120}+\frac{70}{120}=\frac{163}{120}=1\frac{43}{120}.$

(6) $\frac{3}{4}+\frac{4}{7}+\frac{7}{9}=\frac{3\times7\times9}{4\times7\times9}+\frac{4\times4\times9}{7\times4\times9}+\frac{7\times4\times7}{9\times4\times7}$

$=\frac{189}{252}+\frac{144}{252}+\frac{196}{252}=\frac{529}{252}=2\frac{25}{252}.$

(7) $\frac{1}{2}+\frac{5}{6}+\frac{3}{21}=\frac{1\times21}{2\times21}+\frac{5\times7}{6\times7}+\frac{3\times2}{21\times2}$

$=\frac{21}{42}+\frac{35}{42}+\frac{6}{42}=\frac{62}{42}=1\frac{20}{42}=1\frac{10}{21}.$

(8) $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}=\frac{1\times30}{2\times30}+\frac{1\times20}{3\times20}+\frac{1\times15}{4\times15}+\frac{1\times12}{5\times12}$

$=\frac{30}{60}+\frac{20}{60}+\frac{15}{60}+\frac{12}{60}=\frac{77}{60}=1\frac{17}{60}.$

(9) $\frac{5}{7}+\frac{6}{45}+\frac{9}{35}=\frac{5\times45}{7\times45}+\frac{6\times7}{45\times7}+\frac{9\times9}{35\times9}$

$=\frac{225}{315}+\frac{42}{315}+\frac{81}{315}=\frac{348}{315}=1\frac{33}{315}=1\frac{11}{105}.$

(10) $\frac{3}{6}+2\frac{1}{7}+13\frac{3}{10}=15+\frac{1}{2}+\frac{1}{7}+\frac{3}{10}=15+\frac{1\times35}{2\times35}+\frac{1\times10}{7\times10}+\frac{3\times7}{10\times7}$

$=15+\frac{35}{70}+\frac{10}{70}+\frac{21}{70}=15+\frac{66}{70}=15\frac{33}{35}.$

(11) $\frac{3}{5}+\frac{4}{5}$ of $\frac{1}{3}+9\frac{3}{20}=9+\frac{3}{5}+\frac{4}{15}+\frac{3}{20}=9+\frac{3\times12}{5\times12}+\frac{4\times4}{15\times4}+\frac{3\times3}{20\times3}$

$=9+\frac{36}{60}+\frac{16}{60}+\frac{9}{60}=9+\frac{61}{60}=10\frac{1}{60}.$

(12) $\frac{1}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}+5\frac{1}{2}+\frac{2}{19}=\frac{1}{5}+5\frac{1}{2}+\frac{2}{19}=5+\frac{1}{5}+\frac{1}{2}+\frac{2}{19}$

$=5+\frac{1\times38}{190}+\frac{1\times95}{190}+\frac{2\times10}{190}=5+\frac{38}{190}+\frac{95}{190}+\frac{20}{190}=5+\frac{153}{190}=5\frac{15}{19}$

(13) $\frac{7}{5}+\frac{4}{3}+\frac{1}{6}+\frac{11}{30}=\frac{7\times6}{5\times6}+\frac{4\times10}{3\times10}+\frac{1\times5}{6\times5}+\frac{11}{30}$

$=\frac{42}{30}+\frac{40}{30}+\frac{5}{30}+\frac{11}{30}=\frac{98}{30}=3\frac{4}{15}.$

(14) $\frac{10}{14}+\frac{2}{15}+\frac{18}{70}=\frac{5}{7}+\frac{2}{15}+\frac{9}{35}=\frac{5\times 15}{7\times 15}+\frac{2\times 7}{15\times 7}+\frac{9\times 3}{35\times 3}$

$$=\frac{75}{105}+\frac{14}{105}+\frac{27}{105}=\frac{116}{105}=1\tfrac{11}{105}.$$

(15) $\frac{4}{5}+\frac{7}{10}+\frac{4}{7}+\frac{2}{21}=\frac{4\times 42}{5\times 42}+\frac{7\times 21}{10\times 21}+\frac{4\times 30}{7\times 30}+\frac{2\times 10}{21\times 10}$

$$=\frac{168}{210}+\frac{147}{210}+\frac{120}{210}+\frac{20}{210}=\frac{455}{210}=2\tfrac{35}{210}=2\tfrac{1}{6}.$$

(16) $\frac{1}{8}+\frac{7}{12}+\frac{5}{9}+\frac{9}{20}=\frac{1\times 45}{8\times 45}+\frac{7\times 30}{12\times 30}+\frac{5\times 40}{9\times 40}+\frac{9\times 18}{20\times 18}$

$$=\frac{45}{360}+\frac{210}{360}+\frac{200}{360}+\frac{162}{360}=\frac{617}{360}=1\tfrac{257}{360}.$$

(17) $\frac{1}{5}+6\tfrac{4}{5}+\frac{4}{7}\text{ of }\frac{1}{3}=6+\frac{1}{5}+\frac{4}{5}+\frac{4}{21}=6+\frac{5}{5}+\frac{4}{21}=6+1+\frac{4}{21}=7\tfrac{4}{21}.$

(18) $100\tfrac{2}{5}+64\tfrac{5}{9}+\frac{3}{5}\text{ of }701=100+64+420+\frac{2}{5}+\frac{5}{9}+\frac{3}{5}$

$\left(\text{since }\frac{3}{5}\text{ of }701=\frac{2103}{5}=420\tfrac{3}{5}\right),$

$$=584+\frac{5}{5}+\frac{5}{9}=585\tfrac{5}{9}.$$

(19) $261\tfrac{1}{3}+174\tfrac{3}{4}+\frac{5}{6}\text{ of }10\tfrac{1}{2}=261+174+8+\frac{1}{3}+\frac{3}{4}+\frac{3}{4}$

$\left(\text{since }\frac{5}{6}\text{ of }10\tfrac{1}{2}=\frac{5\times 21}{6\times 2}=\frac{35}{4}=8\tfrac{3}{4}\right),$

$$=443+\frac{1}{3}+\frac{6}{4}=443+\frac{1}{3}+1\tfrac{1}{2}=444+\frac{2}{6}+\frac{3}{6}=444\tfrac{5}{6}.$$

(20) $387\tfrac{1}{2}+285\tfrac{1}{4}+394\tfrac{1}{3}+\frac{2}{5}\text{ of }3704$

$$=387+285+394+1481+\frac{1}{2}+\frac{1}{4}+\frac{1}{3}+\frac{3}{5}$$

$\left(\text{since }\frac{2}{5}\text{ of }3704=\frac{7408}{5}=1481\tfrac{3}{5}\right),$

$$=2547+\frac{1\times 30}{2\times 30}+\frac{1\times 15}{4\times 15}+\frac{1\times 20}{3\times 20}+\frac{3\times 12}{5\times 12}$$

$$=2547+\frac{30}{60}+\frac{15}{60}+\frac{20}{60}+\frac{36}{60}$$

$$=2547+\frac{101}{60}=2547+1\tfrac{41}{60}=2548\tfrac{41}{60}.$$

(12) $\frac{15}{4}$, $3\frac{1}{3}$, $\frac{2}{7}$ of $9\frac{2}{5}$, $\frac{2}{7}$ of $\frac{5}{9}$ of $\frac{4}{5}$, or $\frac{15}{4}$, $\frac{10}{3}$, $\frac{94}{35}$, $\frac{8}{63}$.

1260 is L. C. M. of denominators; ∴ fractions become

$$\frac{15\times 315}{4\times 315},\ \frac{10\times 420}{3\times 420},\ \frac{94\times 36}{35\times 36},\ \frac{8\times 20}{63\times 20},$$

$$\text{or } \frac{4725}{1260},\ \frac{4200}{1260},\ \frac{3384}{1260},\ \frac{160}{1260},$$

∴ in order of magnitude the fractions stand thus,

$$\frac{15}{4},\ 3\tfrac{1}{3},\ \frac{2}{7} \text{ of } 9\tfrac{2}{5},\ \frac{2}{7} \text{ of } \frac{5}{9} \text{ of } \frac{4}{5}.$$

2. (1) $\frac{3}{4}$, $\frac{7}{12}$, $\frac{2}{3}$, $\frac{1}{6}$, and $\frac{1}{2}$. 12 is L. C. M. of denominators;

∴ fractions become

$$\frac{3\times 3}{4\times 3},\ \frac{7}{12},\ \frac{2\times 4}{3\times 4},\ \frac{1\times 2}{6\times 2},\ \frac{1\times 6}{2\times 6},\ \text{or } \frac{9}{12},\ \frac{7}{12},\ \frac{8}{12},\ \frac{2}{12},\ \frac{6}{12};$$

∴ $\frac{3}{4}$ is the greatest fraction and $\frac{1}{6}$ the least.

(2) $\frac{11}{12}$, $\frac{29}{30}$, $\frac{17}{18}$, $\frac{7}{16}$, $\frac{47}{48}$. 720 is L. C. M. of denominators;

∴ fractions become

$$\frac{11\times 60}{12\times 60},\ \frac{29\times 24}{30\times 24},\ \frac{17\times 40}{18\times 40},\ \frac{7\times 45}{16\times 45},\ \frac{47\times 15}{48\times 15},$$

$$\text{or } \frac{660}{720},\ \frac{696}{720},\ \frac{680}{720},\ \frac{315}{720},\ \frac{705}{720};$$

∴ $\frac{47}{48}$ is the greatest fraction and $\frac{7}{16}$ the least.

ADDITION OF VULGAR FRACTIONS.

Ex. XIX. (p. 47.)

1. (1) $\frac{2}{3}+\frac{5}{7}=\frac{2\times 7}{3\times 7}+\frac{5\times 3}{7\times 3}=\frac{14}{21}+\frac{15}{21}=\frac{29}{21}=1\frac{8}{21}$.

(2) $\frac{2}{9}+\frac{4}{9}=\frac{6}{9}=\frac{2}{3}$.

(3) $\frac{5}{6}+\frac{7}{8}=\frac{5\times4}{6\times4}+\frac{7\times3}{8\times3}=\frac{20}{24}+\frac{21}{24}=\frac{41}{24}=1\frac{17}{24}$.

(4) $\frac{1}{7}+\frac{4}{21}=\frac{1\times3}{7\times3}+\frac{4}{21}=\frac{3}{21}+\frac{4}{21}=\frac{7}{21}=\frac{1}{3}$.

(5) $\frac{3}{16}+\frac{5}{64}=\frac{3\times4}{16\times4}+\frac{5}{64}=\frac{12}{64}+\frac{5}{64}=\frac{17}{64}$.

(6) $\frac{9}{14}+\frac{13}{21}=\frac{9\times3}{14\times3}+\frac{13\times2}{21\times2}=\frac{27}{42}+\frac{26}{42}=\frac{53}{42}=1\frac{11}{42}$.

(7) $\frac{5}{12}+\frac{7}{18}=\frac{5\times3}{12\times3}+\frac{7\times2}{18\times2}=\frac{15}{36}+\frac{14}{36}=\frac{29}{36}$.

(8) $\frac{3}{24}+\frac{21}{32}=\frac{1}{8}+\frac{21}{32}=\frac{1\times4}{8\times4}+\frac{21}{32}=\frac{4}{32}+\frac{21}{32}=\frac{25}{32}$.

(9) $\frac{3}{5}+2\frac{1}{6}=2+\frac{3}{5}+\frac{1}{6}=2+\frac{3\times6}{5\times6}+\frac{1\times5}{6\times5}=2+\frac{18}{30}+\frac{5}{30}=2\frac{23}{30}$.

(10) $\frac{5}{12}+\frac{7}{13}=\frac{5\times13}{12\times13}+\frac{7\times12}{13\times12}=\frac{65}{156}+\frac{84}{156}=\frac{149}{156}$.

(11) $3\frac{5}{8}+7\frac{2}{5}=10+\frac{5}{8}+\frac{2}{5}=10+\frac{5\times5}{8\times5}+\frac{2\times8}{5\times8}$

$$=10+\frac{25}{40}+\frac{16}{40}=10+\frac{41}{40}=10+1\frac{1}{40}=11\frac{1}{40}.$$

(12) $4\frac{3}{4}+9\frac{11}{12}=13+\frac{3}{4}+\frac{11}{12}=13+\frac{3\times3}{4\times3}+\frac{11}{12}=13+\frac{9}{12}+\frac{11}{12}$

$$=13+\frac{20}{12}=13+1\frac{8}{12}=14\frac{2}{3}.$$

2. (1) $\frac{2}{3}+\frac{5}{6}+\frac{7}{12}=\frac{2\times4}{3\times4}+\frac{5\times2}{6\times2}+\frac{7}{12}=\frac{8}{12}+\frac{10}{12}+\frac{7}{12}=\frac{25}{12}=2\frac{1}{12}$.

(2) $\frac{3}{5}+\frac{2}{7}+\frac{1}{3}=\frac{3\times7\times3}{5\times7\times3}+\frac{2\times5\times3}{7\times5\times3}+\frac{1\times5\times7}{3\times5\times7}$

$$=\frac{63}{105}+\frac{30}{105}+\frac{35}{105}=\frac{128}{105}=1\frac{23}{105}.$$

(3) $\frac{1}{2}+\frac{2}{5}+\frac{1}{10}=\frac{1\times5}{2\times5}+\frac{2\times2}{5\times2}+\frac{1}{10}=\frac{5}{10}+\frac{4}{10}+\frac{1}{10}=\frac{10}{10}=1$.

(4) $\frac{5}{12}+\frac{1}{8}+\frac{7}{24}=\frac{5\times2}{12\times2}+\frac{1\times3}{8\times3}+\frac{7}{24}=\frac{10}{24}+\frac{3}{24}+\frac{7}{24}=\frac{20}{24}=\frac{5}{6}$.

(5) $\frac{2}{5}+\frac{3}{8}+\frac{7}{12}=\frac{2\times24}{5\times24}+\frac{3\times15}{8\times15}+\frac{7\times10}{12\times10}$

$=\frac{48}{120}+\frac{45}{120}+\frac{70}{120}=\frac{163}{120}=1\frac{43}{120}$.

(6) $\frac{3}{4}+\frac{4}{7}+\frac{7}{9}=\frac{3\times7\times9}{4\times7\times9}+\frac{4\times4\times9}{7\times4\times9}+\frac{7\times4\times7}{9\times4\times7}$

$=\frac{189}{252}+\frac{144}{252}+\frac{196}{252}=\frac{529}{252}=2\frac{25}{252}$.

(7) $\frac{1}{2}+\frac{5}{6}+\frac{3}{21}=\frac{1\times21}{2\times21}+\frac{5\times7}{6\times7}+\frac{3\times2}{21\times2}$

$=\frac{21}{42}+\frac{35}{42}+\frac{6}{42}=\frac{62}{42}=1\frac{20}{42}=1\frac{10}{21}$.

(8) $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}=\frac{1\times30}{2\times30}+\frac{1\times20}{3\times20}+\frac{1\times15}{4\times15}+\frac{1\times12}{5\times12}$

$=\frac{30}{60}+\frac{20}{60}+\frac{15}{60}+\frac{12}{60}=\frac{77}{60}=1\frac{17}{60}$.

(9) $\frac{5}{7}+\frac{6}{45}+\frac{9}{35}=\frac{5\times45}{7\times45}+\frac{6\times7}{45\times7}+\frac{9\times9}{35\times9}$

$=\frac{225}{315}+\frac{42}{315}+\frac{81}{315}=\frac{348}{315}=1\frac{33}{315}=1\frac{11}{105}$.

(10) $\frac{3}{6}+2\frac{1}{7}+13\frac{3}{10}=15+\frac{1}{2}+\frac{1}{7}+\frac{3}{10}=15+\frac{1\times35}{2\times35}+\frac{1\times10}{7\times10}+\frac{3\times7}{10\times7}$

$=15+\frac{35}{70}+\frac{10}{70}+\frac{21}{70}=15+\frac{66}{70}=15\frac{33}{35}$.

(11) $\frac{3}{5}+\frac{4}{5}$ of $\frac{1}{3}+9\frac{3}{20}=9+\frac{3}{5}+\frac{4}{15}+\frac{3}{20}=9+\frac{3\times12}{5\times12}+\frac{4\times4}{15\times4}+\frac{3\times3}{20\times3}$

$=9+\frac{36}{60}+\frac{16}{60}+\frac{9}{60}=9+\frac{61}{60}=10\frac{1}{60}$.

(12) $\frac{1}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}+5\frac{1}{2}+\frac{2}{19}=\frac{1}{5}+5\frac{1}{2}+\frac{2}{19}=5+\frac{1}{5}+\frac{1}{2}+\frac{2}{19}$

$=5+\frac{1\times38}{190}+\frac{1\times95}{190}+\frac{2\times10}{190}=5+\frac{38}{190}+\frac{95}{190}+\frac{20}{190}=5+\frac{153}{190}=5\frac{153}{190}$.

(13) $\frac{7}{5}+\frac{4}{3}+\frac{1}{6}+\frac{11}{30}=\frac{7\times6}{5\times6}+\frac{4\times10}{3\times10}+\frac{1\times5}{6\times5}+\frac{11}{30}$

$=\frac{42}{30}+\frac{40}{30}+\frac{5}{30}+\frac{11}{30}=\frac{98}{30}=3\frac{4}{15}$.

(14) $$\frac{10}{14}+\frac{2}{15}+\frac{18}{70}=\frac{5}{7}+\frac{2}{15}+\frac{9}{35}=\frac{5\times15}{7\times15}+\frac{2\times7}{15\times7}+\frac{9\times3}{35\times3}$$
$$=\frac{75}{105}+\frac{14}{105}+\frac{27}{105}=\frac{116}{105}=1\tfrac{11}{105}.$$

(15) $$\frac{4}{5}+\frac{7}{10}+\frac{4}{7}+\frac{2}{21}=\frac{4\times42}{5\times42}+\frac{7\times21}{10\times21}+\frac{4\times30}{7\times30}+\frac{2\times10}{21\times10}$$
$$=\frac{168}{210}+\frac{147}{210}+\frac{120}{210}+\frac{20}{210}=\frac{455}{210}=2\tfrac{35}{210}=2\tfrac{1}{6}.$$

(16) $$\frac{1}{8}+\frac{7}{12}+\frac{5}{9}+\frac{9}{20}=\frac{1\times45}{8\times45}+\frac{7\times30}{12\times30}+\frac{5\times40}{9\times40}+\frac{9\times18}{20\times18}$$
$$=\frac{45}{360}+\frac{210}{360}+\frac{200}{360}+\frac{162}{360}=\frac{617}{360}=1\tfrac{257}{360}.$$

(17) $$\frac{1}{5}+6\tfrac{4}{5}+\frac{4}{7}\text{ of }\frac{1}{3}=6+\frac{1}{5}+\frac{4}{5}+\frac{4}{21}=6+\frac{5}{5}+\frac{4}{21}=6+1+\frac{4}{21}=7\tfrac{4}{21}.$$

(18) $$100\tfrac{2}{5}+64\tfrac{5}{9}+\frac{3}{5}\text{ of }701=100+64+420+\frac{2}{5}+\frac{5}{9}+\frac{3}{5}$$
$$\left(\text{since }\frac{3}{5}\text{ of }701=\frac{2103}{5}=420\tfrac{3}{5}\right),$$
$$=584+\frac{5}{5}+\frac{5}{9}=585\tfrac{5}{9}.$$

(19) $$261\tfrac{1}{3}+174\tfrac{3}{4}+\frac{5}{6}\text{ of }10\tfrac{1}{2}=261+174+8+\frac{1}{3}+\frac{3}{4}+\frac{3}{4}$$
$$\left(\text{since }\frac{5}{6}\text{ of }10\tfrac{1}{2}=\frac{5\times21}{6\times2}=\frac{35}{4}=8\tfrac{3}{4}\right),$$
$$=443+\frac{1}{3}+\frac{6}{4}=443+\frac{1}{3}+1\tfrac{1}{2}=444+\frac{2}{6}+\frac{3}{6}=444\tfrac{5}{6}.$$

(20) $$387\tfrac{1}{2}+285\tfrac{1}{4}+394\tfrac{1}{3}+\frac{2}{5}\text{ of }3704$$
$$=387+285+394+1481+\frac{1}{2}+\frac{1}{4}+\frac{1}{3}+\frac{3}{5}$$
$$\left(\text{since }\frac{2}{5}\text{ of }3704=\frac{7408}{5}=1481\tfrac{3}{5}\right),$$
$$=2547+\frac{1\times30}{2\times30}+\frac{1\times15}{4\times15}+\frac{1\times20}{3\times20}+\frac{3\times12}{5\times12}$$
$$=2547+\frac{30}{60}+\frac{15}{60}+\frac{20}{60}+\frac{36}{60}$$
$$=2547+\frac{101}{60}=2547+1\tfrac{41}{60}=2548\tfrac{41}{60}.$$

3. (1) $\frac{11}{10}+\frac{11}{100}+\frac{11}{1000}+\frac{11}{10000}=\frac{11\times1000}{10\times1000}+\frac{11\times100}{100\times100}+\frac{11\times10}{1000\times10}+\frac{11}{10000}$

$$=\frac{11000+1100+110+11}{10000}=\frac{12221}{10000}=1\tfrac{2221}{10000}.$$

(2) $\frac{11}{12}+\frac{17}{18}+\frac{29}{30}+\frac{47}{48}+\frac{59}{60}$

$$=\frac{11\times60}{12\times60}+\frac{17\times40}{18\times40}+\frac{29\times24}{30\times24}+\frac{47\times15}{48\times15}+\frac{59\times12}{60\times12}$$

$$=\frac{660+680+696+705+708}{720}=\frac{3449}{720}=4\tfrac{569}{720}.$$

(3) $\frac{1}{2}+\frac{1}{9}+\frac{3}{17}+\frac{29}{38}+\frac{33}{34}$ (5814 is L. C. M. of denominators)

$$=\frac{1\times2907}{2\times2907}+\frac{1\times646}{9\times646}+\frac{3\times342}{17\times342}+\frac{29\times153}{38\times153}+\frac{33\times171}{34\times171}$$

$$=\frac{2907+646+1026+4437+5643}{5814}=\frac{14659}{5814}=2\tfrac{3031}{5814}.$$

(4) $2\tfrac{11}{17}+6\tfrac{21}{34}+\frac{16}{51}+\frac{1}{3}\text{ of }\frac{16}{17}+\frac{29}{68}+\frac{1}{3}\text{ of }2\tfrac{3}{4}$

$$=2+6+\frac{11}{17}+\frac{21}{34}+\frac{16}{51}+\frac{16}{51}+\frac{29}{68}+\frac{11}{12}$$

$$=8+\frac{11\times12}{17\times12}+\frac{21\times6}{34\times6}+\frac{32\times4}{51\times4}+\frac{29\times3}{68\times3}+\frac{11\times17}{12\times17}$$

$$=8+\frac{132+126+128+87+187}{204}=8+\frac{660}{204}=8+3\tfrac{48}{204}=11\tfrac{4}{17}.$$

(5) $2\tfrac{2}{3}+3\tfrac{3}{4}+4\tfrac{4}{5}+5\tfrac{5}{6}+6\tfrac{6}{7}=2+3+4+5+6+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\frac{5}{6}+\frac{6}{7}$

$$=20+\frac{2\times140+3\times105+4\times84+5\times70+6\times60}{420}$$

$$=20+\frac{280+315+336+350+360}{420}$$

$$=20+\frac{1641}{420}=20+3\tfrac{381}{420}=23\tfrac{127}{140}.$$

(6) $1\tfrac{4}{7}+3\tfrac{1}{10}+\frac{13}{15}+7\tfrac{5}{16}+\frac{9}{28}+\frac{2}{7}\text{ of }\frac{1}{5}=1+3+7+\frac{4}{7}+\frac{1}{10}+\frac{13}{15}+\frac{5}{16}+\frac{9}{28}+\frac{2}{35}$

$$=11+\frac{4\times240+1\times168+13\times112+5\times105+9\times60+2\times48}{1680}$$

$$=11+\frac{960+168+1456+525+540+96}{1680}=11+\frac{3745}{1680}=11+2\tfrac{385}{1680}=13\tfrac{11}{48}.$$

(7) $5\frac{1}{6}+\frac{8}{9}\text{ of }\frac{6}{7}\text{ of }3\frac{1}{2}+9\frac{3}{10}+\frac{3}{7}\text{ of }\frac{5}{8}\text{ of }4=5+2+9+1+\frac{1}{6}+\frac{2}{3}+\frac{3}{10}+\frac{1}{14}$

$$\left(\text{since }\frac{8}{9}\text{ of }\frac{6}{7}\text{ of }\frac{7}{2}=\frac{8}{3}=2\frac{2}{3},\text{ and }\frac{3}{7}\text{ of }\frac{5}{8}\text{ of }4=\frac{15}{14}=1\frac{1}{14}\right),$$

$$=17+\frac{1\times35+2\times70+3\times21+1\times15}{210}=17+\frac{35+140+63+15}{210}$$

$$=17+\frac{253}{210}=17+1\frac{43}{210}=18\frac{43}{210}.$$

(8) $\frac{5}{8}\text{ of }12+\frac{3}{5}\text{ of }\frac{8}{9}+3\frac{3}{8}\text{ of }1\frac{8}{9}\text{ of }\frac{14}{153}+\frac{13}{15}\text{ of }3\frac{3}{4}\text{ of }\frac{1}{81}\text{ of }1\frac{1}{26}$

$$=\frac{15}{2}+\frac{8}{15}+\frac{7}{12}+\frac{1}{24}=\frac{15\times60+8\times8+7\times10+1\times5}{120}$$

$$=\frac{900+64+70+5}{120}=\frac{1039}{120}=8\frac{79}{120}.$$

(9) $270\frac{3}{4}+650\frac{3}{20}+5000\frac{1}{4}+53\frac{4}{5}+1\frac{1}{20}$

$$=270+650+5000+53+1+\frac{3}{4}+\frac{3}{20}+\frac{1}{4}+\frac{4}{5}+\frac{1}{20}$$

$$=5974+\frac{15+3+5+16+1}{20}=5974+\frac{40}{20}=5974+2=5976.$$

(10) $\frac{1}{2}\text{ of }\frac{3}{4}+\frac{7}{31}\text{ of }\left(1+\frac{15}{16}\right)+\frac{31}{32}+\frac{63}{64}\text{ of }\left(1+\frac{1}{2}\right)$

$$=\frac{3}{8}+\frac{7}{31}\text{ of }\frac{31}{16}+\frac{31}{32}+\frac{63}{64}\text{ of }\frac{3}{2}=\frac{3}{8}+\frac{7}{16}+\frac{31}{32}+\frac{189}{128}$$

$$=\frac{3\times16+7\times8+31\times4+189}{128}=\frac{48+56+124+189}{128}=\frac{417}{128}=3\frac{33}{128}.$$

SUBTRACTION OF VULGAR FRACTIONS.

Ex. XX. (p. 49.)

1. (1) $\frac{3}{4}-\frac{1}{2}=\frac{3}{4}-\frac{1\times2}{2\times2}=\frac{3}{4}-\frac{2}{4}=\frac{1}{4}.$

(2) $\frac{5}{8}-\frac{1}{4}=\frac{5}{8}-\frac{1\times2}{4\times2}=\frac{5}{8}-\frac{2}{8}=\frac{3}{8}.$

(3) $\frac{4}{9}-\frac{3}{11}=\frac{4\times11}{9\times11}-\frac{3\times9}{11\times9}=\frac{44}{99}-\frac{27}{99}=\frac{17}{99}.$

(4) $\frac{7}{12}-\frac{8}{15}=\frac{7\times 5}{12\times 5}-\frac{8\times 4}{15\times 4}=\frac{35}{60}-\frac{32}{60}=\frac{3}{60}=\frac{1}{20}.$

(5) $\frac{17}{18}-\frac{11}{12}=\frac{17\times 2}{18\times 2}-\frac{11\times 3}{12\times 3}=\frac{34}{36}-\frac{33}{36}=\frac{1}{36}.$

(6) $\frac{8}{15}-\frac{9}{20}=\frac{8\times 4}{15\times 4}-\frac{9\times 3}{20\times 3}=\frac{32}{60}-\frac{27}{60}=\frac{5}{60}=\frac{1}{12}.$

(7) $2\tfrac{3}{5}-1\tfrac{1}{3}=(2-1)+\left(\frac{3}{5}-\frac{1}{3}\right)=1+\frac{3\times 3}{5\times 3}-\frac{1\times 5}{3\times 5}=1+\frac{9-5}{15}=1\tfrac{4}{15}.$

(8) $37\tfrac{4}{15}-33\tfrac{5}{24}=4+\frac{4}{15}-\frac{5}{24}=4+\frac{4\times 8}{15\times 8}-\frac{5\times 5}{24\times 5}=4+\frac{32-25}{120}=4\tfrac{7}{120}.$

(9) $6\tfrac{3}{8}-4\tfrac{1}{2}=\frac{51}{8}-\frac{9}{2}=\frac{51}{8}-\frac{9\times 4}{2\times 4}=\frac{51-36}{8}=\frac{15}{8}=1\tfrac{7}{8};$

or thus,

$$6\tfrac{3}{8}-4\tfrac{1}{2}=6+1+\frac{3}{8}-5\tfrac{1}{2}=6\tfrac{11}{8}-5\tfrac{1}{2}=1+\frac{11}{8}-\frac{1}{2}=1+\frac{11}{8}-\frac{4}{8}=1\tfrac{7}{8}.$$

(10) $13\tfrac{5}{12}-9\tfrac{7}{13}=13\tfrac{17}{12}-10\tfrac{7}{13}=3+\frac{17}{12}-\frac{7}{13}$

$$=3+\frac{17\times 13}{12\times 13}-\frac{7\times 12}{13\times 12}=3+\frac{221-84}{156}=3\tfrac{137}{156}.$$

(11) $50\tfrac{1}{16}-47\tfrac{1}{24}=3+\frac{1}{16}-\frac{1}{24}=3+\frac{1\times 3}{16\times 3}-\frac{1\times 2}{24\times 2}=3+\frac{3-2}{48}=3\tfrac{1}{48}.$

(12) $42-30\tfrac{5}{12}=42+1-31\tfrac{5}{12}=11+1-\frac{5}{12}=11+\frac{12}{12}-\frac{5}{12}=11\tfrac{7}{12}.$

(13) $15\tfrac{32}{729}-1\tfrac{16}{243}=15+1+\frac{32}{729}-2\tfrac{16}{243}$

$$=13+\frac{761}{729}-\frac{16}{243}=13+\frac{761}{729}-\frac{48}{729}=13\tfrac{713}{729}.$$

(14) $90\tfrac{10}{111}-25\tfrac{12}{125}=90+1+\frac{10}{111}-26\tfrac{12}{125}=64+\frac{121}{111}-\frac{12}{125}$

$$=64+\frac{121\times 125}{111\times 125}-\frac{12\times 111}{111\times 125}=64+\frac{15125-1332}{13875}=64\tfrac{13793}{13875}.$$

(15) $21-1\tfrac{179}{298}=21+1-2\tfrac{179}{298}=19+\frac{298}{298}-\frac{179}{298}=19+\frac{298-179}{298}=19\tfrac{119}{298}.$

(16) $125-\frac{2}{7}$ of $14=125-4=121.$

(17) $46\tfrac{5}{8}-15\tfrac{1}{6}=31+\frac{5}{8}-\frac{1}{6}=31+\frac{5\times 3}{8\times 3}-\frac{1\times 4}{6\times 4}=31+\frac{15-4}{24}=31\tfrac{11}{24}.$

(18) $\frac{13}{56}-\frac{5}{28}\text{ of }1\frac{1}{5}=\frac{13}{56}-\frac{3}{14}=\frac{13}{56}-\frac{3\times 4}{14\times 4}=\frac{13-12}{56}=\frac{1}{56}.$

(19) $\frac{1}{2}\text{ of }\frac{4}{5}\text{ of }\frac{3}{4}-\frac{2}{9}\text{ of }\frac{3}{4}=\frac{3}{10}-\frac{1}{6}=\frac{3\times 3}{10\times 3}-\frac{1\times 5}{6\times 5}=\frac{9-5}{30}=\frac{4}{30}=\frac{2}{15}.$

(20) $\frac{3}{7}\text{ of }\frac{2}{9}\text{ of }\frac{4}{5}\text{ of }8\frac{3}{4}-\frac{5}{8}\text{ of }\frac{4}{5}\text{ of }\frac{11}{18}\text{ of }1\frac{7}{11}$

$=\frac{2}{3}-\frac{1}{2}=\frac{2\times 2}{3\times 2}-\frac{1\times 3}{2\times 3}=\frac{4-3}{6}=\frac{1}{6}.$

2. $\frac{5}{8}\text{ of }\frac{4}{10}-\frac{7}{9}\text{ of }\frac{4}{21}=\frac{1}{4}-\frac{4}{27}=\frac{1\times 27}{4\times 27}-\frac{4\times 4}{27\times 4}=\frac{27-16}{108}=\frac{11}{108},$

$\frac{5}{6}\text{ of }\frac{2}{15}-\frac{3}{8}\text{ of }\frac{4}{18}=\frac{1}{9}-\frac{1}{12}=\frac{1\times 4}{9\times 4}-\frac{1\times 3}{12\times 3}=\frac{4-3}{36}=\frac{1}{36};$

$\therefore$ difference $=\frac{11}{108}-\frac{1}{36}=\frac{11}{108}-\frac{1\times 3}{36\times 3}=\frac{11-3}{108}=\frac{8}{108}=\frac{2}{27}.$

3. $\frac{8}{15}\text{ of }\frac{5}{6}+2\frac{7}{8}=\frac{4}{9}+2\frac{7}{8}=2+\frac{4\times 8}{9\times 8}+\frac{7\times 9}{8\times 9}=2+\frac{32+63}{72}=2+\frac{95}{72};$

$\therefore$ required result $=2+\frac{95}{72}-\frac{5}{9}=2+\frac{95}{72}-\frac{5\times 8}{9\times 8}=2+\frac{95-40}{72}=2\frac{55}{72}.$

4. $11\frac{2}{3}+8\frac{7}{9}=19+\frac{2}{3}+\frac{7}{9}=19+\frac{6}{9}+\frac{7}{9}=19+\frac{13}{9};$

$\therefore$ result $=19+\frac{13}{9}-9\frac{19}{22}=10+\frac{13\times 22}{9\times 22}-\frac{19\times 9}{9\times 22}=10+\frac{286-171}{198}=10\frac{115}{198}.$

5. Difference of two first fractions

$=5\frac{23}{32}-2\frac{2}{7}=3+\frac{23\times 7}{32\times 7}-\frac{2\times 32}{7\times 32}=3+\frac{161-64}{224}=3+\frac{97}{224}.$

Sum of

$\frac{5}{8}+\frac{5}{14}+\frac{1}{6}=\frac{5\times 21}{8\times 21}+\frac{5\times 12}{14\times 12}-\frac{1\times 28}{6\times 28}=\frac{105+60+28}{168}=\frac{193}{168}=1\frac{25}{168};$

$\therefore$ result $=3\frac{97}{224}-1\frac{25}{168}=2+\frac{97}{224}-\frac{25}{168}=2+\frac{97\times 3}{224\times 3}-\frac{25\times 4}{168\times 4}$

$=2+\frac{291-100}{672}=2\frac{191}{672}.$

6. Sum of fractions $=1\frac{1}{26}+\frac{9}{13}=\frac{27}{26}+\frac{9}{13}=\frac{27+18}{26}=\frac{45}{26}.$

difference of fractions $=\frac{27-18}{26}=\frac{9}{26}.$

Now $\frac{45}{26}=\frac{9}{26}\times 5;$ $\therefore$ sum $=5$ times difference.

MULTIPLICATION OF VULGAR FRACTIONS.

Ex. XXI. (p. 52.)

1. (1) $\frac{5}{7}\times\frac{2}{3}=\frac{5\times 2}{7\times 3}=\frac{10}{21}.$ (2) $\frac{8}{9}\times\frac{13}{15}=\frac{8\times 13}{9\times 15}=\frac{104}{135}.$

(3) $\frac{3}{4}\times\frac{8}{9}=\frac{3\times 8}{4\times 9}=\frac{3\times 4\times 2}{4\times 3\times 3}=\frac{2}{3}.$

(4) $\frac{5}{12}\times\frac{8}{15}=\frac{5\times 8}{12\times 15}=\frac{5\times 4\times 2}{4\times 3\times 3\times 5}=\frac{2}{9}.$

(5) $\frac{51}{60}\times\frac{16}{17}=\frac{51\times 16}{60\times 17}=\frac{3\times 17\times 4\times 4}{4\times 3\times 5\times 17}=\frac{4}{5}.$

(6) $7\frac{1}{2}\times\frac{1}{3}=\frac{15\times 1}{2\times 3}=\frac{5\times 3}{2\times 3}=\frac{5}{2}=2\frac{1}{2}.$

(7) $3\frac{7}{9}\times 2\frac{2}{3}=\frac{34\times 8}{9\times 3}=\frac{272}{27}=10\frac{2}{27}.$

(8) $7\frac{1}{2}\times\frac{1}{5}$ of $\frac{4}{9}=\frac{15\times 1\times 4}{2\times 5\times 9}=\frac{3\times 5\times 2\times 2}{2\times 5\times 3\times 3}=\frac{2}{3}.$

(9) $12\times\frac{2}{3}$ of $5=\frac{12\times 2\times 5}{3}=\frac{4\times 3\times 2\times 5}{3}=40.$

(10) $\frac{1}{2}$ of $\frac{2}{3}\times 5\frac{3}{8}$ of $3=\frac{1\times 2\times 43\times 3}{2\times 3\times 8}=\frac{43}{8}=5\frac{3}{8}.$

(11) $\frac{12}{13}$ of $3\frac{2}{3}\times 1\frac{1}{33}$ of $\frac{39}{51}$ of $\frac{3}{8}$

$$=\frac{12\times 11\times 34\times 39\times 3}{13\times 3\times 33\times 51\times 8}=\frac{4\times 3\times 11\times 2\times 17\times 3\times 13\times 3}{13\times 3\times 3\times 11\times 3\times 17\times 4\times 2}=1.$$

(12) $\frac{11}{15}$ of $1\frac{3}{22}$ of $\frac{1}{70}\times\frac{7}{12}$ of $37\frac{14}{35}$ of $3\frac{1}{8}$ of $\frac{1}{11}$

$$=\frac{11\times 25\times 1\times 7\times 1309\times 25\times 1}{15\times 22\times 70\times 12\times 35\times 8\times 11}$$

$$=\frac{11\times 5\times 5\times 7\times 11\times 7\times 17\times 5\times 5}{5\times 3\times 2\times 11\times 2\times 5\times 7\times 12\times 5\times 7\times 8\times 11}$$

$$=\frac{17\times 5}{3\times 2\times 2\times 12\times 8}=\frac{85}{1152}.$$

(13) $$\frac{3}{8}\text{ of }2\frac{1}{16}\text{ of }1\frac{1}{63}\text{ of }3\frac{5}{87}\times\frac{3}{11}\text{ of }\frac{10}{19}=\frac{3\times33\times64\times266\times3\times10}{8\times16\times63\times87\times11\times19}$$

$$=\frac{3\times3\times11\times8\times8\times2\times7\times19\times3\times2\times5}{8\times8\times2\times7\times3\times3\times3\times29\times11\times19}=\frac{10}{29}.$$

(14) $$5\frac{2}{19}\text{ of }3\frac{1}{4}\text{ of }\frac{8}{117}\text{ of }34\times\frac{3}{194}\text{ of }\frac{9}{68}\text{ of }1\frac{1}{3}\times19$$

$$=\frac{97\times13\times8\times34\times3\times9\times4\times19}{19\times4\times117\times194\times68\times3}$$

$$=\frac{97\times13\times4\times2\times2\times17\times3\times9\times2\times2\times19}{19\times2\times2\times9\times13\times2\times97\times4\times17\times3}=2.$$

2. (1) $$\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}\times\frac{4}{5}\times\frac{5}{6}=\frac{1\times2\times3\times4\times5}{2\times3\times4\times5\times6}=\frac{1}{6}.$$

(2) $$\frac{15}{64}\times\frac{16}{27}\times\frac{11}{10}\times\frac{72}{385}\times\frac{21}{85}=\frac{15\times16\times11\times72\times21}{64\times27\times10\times385\times85}$$

$$=\frac{5\times3\times16\times11\times4\times2\times9\times3\times7}{4\times16\times3\times9\times2\times5\times11\times5\times7\times5\times17}=\frac{3}{5\times5\times17}=\frac{3}{425}.$$

(3) $$1\frac{17}{15}\times2\frac{2}{3}\text{ of }1\frac{7}{37}\times\frac{33}{42}\times\frac{19}{328}\times5\frac{1}{22}\text{ of }49\times\frac{3}{76}$$

$$=\frac{32\times8\times44\times33\times19\times111\times49\times3}{15\times3\times37\times42\times328\times22\times76}$$

$$=\frac{4\times8\times2\times2\times2\times11\times4\times3\times11\times19\times3\times37\times7\times7\times3}{5\times3\times3\times37\times2\times3\times7\times8\times41\times2\times11\times4\times19}$$

$$=\frac{2\times4\times11\times7}{5\times41}=\frac{616}{205}=3\frac{1}{205}.$$

(4) $$\frac{5}{6}\times2\frac{3}{4}\times3\frac{5}{11}\times5\frac{2}{19}\times6\frac{1}{194}=\frac{5\times11\times38\times97\times1165}{6\times4\times11\times19\times194}$$

$$=\frac{5\times11\times2\times19\times97\times1165}{2\times3\times4\times11\times19\times2\times97}=\frac{5\times1165}{2\times3\times4}=\frac{5825}{24}=242\frac{17}{24}.$$

(5) $$\frac{95}{116}\times\frac{17}{21}\times\frac{87}{153}\times\frac{126}{190}\times\frac{4}{7}\text{ of }1\frac{2}{5}=\frac{95\times17\times87\times126\times4\times7}{116\times21\times153\times190\times7\times5}$$

$$=\frac{5\times19\times17\times3\times29\times9\times2\times7\times4\times7}{4\times29\times3\times7\times9\times17\times19\times2\times5\times7\times5}=\frac{1}{5}.$$

(6) $$\frac{147}{196}\times\frac{1764}{1491}\times\frac{355}{529}\times\frac{207}{507}\times1\frac{110}{189}=\frac{147\times1764\times355\times207\times299}{196\times1491\times529\times507\times189}$$

$$=\frac{49\times3\times4\times441\times5\times71\times9\times23\times13\times23}{49\times4\times7\times213\times23\times23\times13\times39\times9\times21}=\frac{3\times441\times5\times71}{7\times213\times39\times21}$$

$$=\frac{3\times3\times7\times21\times5\times71}{7\times3\times71\times3\times13\times21}=\frac{5}{13}.$$

(6) $\dfrac{56}{1\frac{5}{9}}=\dfrac{\frac{56}{1}}{\frac{14}{9}}=\dfrac{56}{1}\times\dfrac{9}{14}=\dfrac{4\times14\times9}{14}=36.$

(7) $\dfrac{13\frac{9}{10}}{1\frac{11}{14}}=\dfrac{\frac{139}{10}}{\frac{25}{14}}=\dfrac{139}{10}\times\dfrac{14}{25}=\dfrac{139\times2\times7}{2\times5\times25}=\dfrac{139\times7}{5\times25}=\dfrac{973}{125}=7\frac{98}{125}.$

MISCELLANEOUS EXAMPLES IN FRACTIONS.

Ex. XXIII. (p. 58.)

I.

2. $\dfrac{2\frac{1}{2}}{5}$ of $7\frac{3}{4}=\dfrac{\frac{5}{2}}{\frac{5}{1}}$ of $\dfrac{31}{4}=\dfrac{5}{2}\times\dfrac{1}{5}\times\dfrac{31}{4}=\dfrac{31}{8}$, $1\frac{3}{4}\div2\frac{1}{8}=\dfrac{7}{4}\div\dfrac{17}{8}=\dfrac{7}{4}\times\dfrac{8}{17}=\dfrac{14}{17}$;

$\therefore$ sum $=\dfrac{31}{8}+\dfrac{14}{17}=\dfrac{31\times17+14\times8}{8\times17}=\dfrac{527+112}{136}=\dfrac{639}{136}=4\frac{95}{136}$,

difference $=\dfrac{527-112}{136}=\dfrac{415}{136}=3\frac{7}{136}.$

Also sum of $5\frac{1}{8}+\dfrac{2}{3}$ of $3\frac{1}{2}+\dfrac{3}{4}\div\dfrac{6}{7}$

$=5\frac{1}{8}+2\frac{1}{3}+\dfrac{7}{8}=7+\dfrac{1}{8}+\dfrac{1}{3}+\dfrac{7}{8}=7+\dfrac{8}{8}+\dfrac{1}{3}=8\frac{1}{3}.$

3. (1) $\left(\dfrac{3}{4}+\dfrac{7}{6}\text{ of }5\frac{1}{2}\right)\times\left(\dfrac{5}{6}+\dfrac{2}{3}+3\frac{3}{4}\right)=\left(\dfrac{3}{4}+\dfrac{7}{6}\times\dfrac{11}{2}\right)\times\left(3+\dfrac{5}{6}+\dfrac{2}{3}+\dfrac{3}{4}\right)$

$=\left(\dfrac{9}{12}+\dfrac{77}{12}\right)\times\left(3+\dfrac{10}{12}+\dfrac{8}{12}+\dfrac{9}{12}\right)=\dfrac{86}{12}\times3\frac{27}{12}=\dfrac{43}{6}\times3\frac{9}{4}$

$=\dfrac{43}{6}\times\dfrac{21}{4}=\dfrac{43\times3\times7}{2\times3\times4}=\dfrac{301}{8}=37\frac{5}{8}.$

(2) $3\frac{1}{125}$ of $3\frac{4}{7}\div\dfrac{47}{345}$ of $9=\dfrac{376}{125}$ of $\dfrac{25}{7}\times\dfrac{345}{47\times9}$

$=\dfrac{8\times47}{5\times25}\times\dfrac{25}{7}\times\dfrac{5\times3\times23}{47\times3\times3}=\dfrac{8\times23}{7\times3}=\dfrac{184}{21}=8\frac{16}{21}.$

(3) $$\frac{3\frac{3}{4}}{4\frac{2}{7}}-\frac{3\frac{2}{5}}{4\frac{1}{4}}+\frac{\frac{4}{7}}{2\frac{1}{2}}=\frac{\frac{15}{4}}{\frac{30}{7}}-\frac{\frac{17}{5}}{\frac{17}{4}}+\frac{\frac{4}{7}}{\frac{5}{2}}=\frac{15\times7}{4\times30}-\frac{17\times4}{5\times17}+\frac{4\times2}{7\times5}=\frac{7}{8}-\frac{4}{5}+\frac{8}{35}$$

$$=\frac{7\times35-4\times7\times8+8\times8}{8\times35}=\frac{245-224+64}{280}=\frac{85}{280}=\frac{17}{56}.$$

(4) $$\frac{4\frac{1}{3}\times4\frac{1}{3}\times4\frac{1}{3}-1}{4\frac{1}{3}\times4\frac{1}{3}-1}=\frac{\frac{13}{3}\times\frac{13}{3}\times\frac{13}{3}-1}{\frac{13}{3}\times\frac{13}{3}-1}=\frac{\frac{2197}{27}-1}{\frac{169}{9}-1}=\frac{\frac{2197-27}{27}}{\frac{169-9}{9}}$$

$$=\frac{2170}{27}\times\frac{9}{160}=\frac{217\times9}{9\times3\times16}=\frac{217}{48}=4\frac{25}{48}.$$

(5) $$3+\frac{1}{7+\frac{1}{16}}=3+\frac{1}{\frac{112+1}{16}}=3+\frac{16}{113}=\frac{339+16}{113}=\frac{355}{113}=3\frac{16}{113}.$$

4. $\frac{2+4+6}{3+5+7}=\frac{12}{15}=\frac{4}{5}.$

Now $\frac{2}{3}$, $\frac{4}{5}$, $\frac{6}{7}$, are equivalent to $\frac{70}{105}$, $\frac{84}{105}$, $\frac{90}{105}$;

$\therefore \frac{2+4+6}{3+5+7}$ does lie between the greatest and least of the fractions, $\frac{2}{3}$, $\frac{4}{5}$, $\frac{6}{7}$, since $\frac{2}{3}$ is the least, and $\frac{6}{7}$ the greatest.

5. By the question, the smaller number

$$=20\frac{11}{15}-15\frac{4}{35}=5+\frac{11\times7-4\times3}{105}=5+\frac{77-12}{105}=5\frac{65}{105}=5\frac{13}{21}.$$

II.

2. By the question, the number $=41\frac{1}{4}-19\frac{1}{2}=21\frac{3}{4}$.

By the question,

$$\text{number}=3\frac{1}{2}\text{ of }\frac{4}{5}\div2\frac{4}{10}\text{ of }\frac{4}{13}=\frac{7}{2}\times\frac{4}{5}\div\frac{24}{10}\text{ of }\frac{4}{13}=\frac{7}{2}\times\frac{4}{5}\times\frac{10}{24}\times\frac{13}{4}$$

$$=\frac{7\times4\times2\times5\times13}{2\times5\times24\times4}=\frac{91}{24}3\frac{19}{24}.$$

3. $\frac{93208}{13786}=\frac{93208\div122}{13786\div122}=\frac{764}{113}$; $\frac{95469}{359784}=\frac{95469\div789}{359784\div789}=\frac{121}{456}.$

2. (1) $\frac{3}{4} \times \frac{7}{11} \times 8\frac{1}{5} \div \frac{2}{5}\left(7\frac{3}{4} + \frac{5}{2}\right) = \frac{3}{4} \times \frac{7}{11} \times \frac{41}{5} \div \frac{2}{5} \text{ of } 7\frac{13}{4}$

$$= \frac{3}{4} \times \frac{7}{11} \times \frac{41}{5} \div \frac{2}{5} \text{ of } \frac{41}{4} = \frac{3 \times 7 \times 41 \times 5 \times 4}{4 \times 11 \times 5 \times 2 \times 41} = \frac{3 \times 7}{11 \times 2} = \frac{21}{22}.$$

(2) $\frac{1}{8} - \frac{1}{12} + \frac{1}{15} - \frac{1}{20} = \frac{15 - 10 + 8 - 6}{120} = \frac{23 - 16}{120} = \frac{7}{120}.$

(3) $\frac{27968}{37376} = \frac{27968 \div 64}{37376 \div 64} = \frac{437}{584}.$

(4) $\frac{1}{13} \text{ of } (1 + 5\frac{1}{2}) + \frac{5}{6} \text{ of } \frac{1}{27} \text{ of } (7 - 2\frac{2}{5}) - \frac{1}{3}$

$$= \frac{1}{13} \text{ of } 6\frac{1}{2} + \frac{5}{6} \text{ of } \frac{1}{27} \text{ of } 4\frac{3}{5} - \frac{1}{3} = \frac{1}{13} \times \frac{13}{2} + \frac{5}{6} \times \frac{1}{27} \times \frac{23}{5} - \frac{1}{3}$$

$$= \frac{1}{2} + \frac{23}{162} - \frac{1}{3} = \frac{81 + 23 - 54}{162} = \frac{50}{162} = \frac{25}{81}.$$

(5) $\dfrac{\frac{10}{3} + \frac{5}{6} - \frac{20}{21}}{\frac{5}{6} - \frac{4}{7}} = \dfrac{\frac{140 + 35 - 40}{42}}{\frac{35 - 24}{42}} = \frac{135}{11} = 12\frac{3}{11}.$

3. Number $= 3\frac{1}{4} - \frac{3}{4} \text{ of } \left(\frac{1}{3} + \frac{1}{5} - \frac{4}{15} + \frac{1}{9}\right) = \frac{13}{4} - \frac{3}{4} \text{ of } \left(\frac{15 + 9 - 12 + 5}{45}\right)$

$$= \frac{13}{4} - \frac{3}{4} \times \frac{17}{45} = \frac{13}{4} - \frac{17}{60} = \frac{195 - 17}{60} = \frac{178}{60} = 2\frac{29}{30};$$

and number $= \frac{64}{315} \times \frac{1}{4} \times \frac{1}{6} \times \frac{1}{8} = \frac{1}{315 \times 3} = \frac{1}{945}.$

4. After paying away $\frac{1}{3}$ of my money, $\frac{2}{3}$ remains;

after paying away $\frac{1}{2}$ of $\frac{2}{3}$ of my money, $\frac{2}{3} - \frac{1}{2}$ of $\frac{2}{3}$, or, $\frac{1}{3}$ remains;

after paying away $\frac{1}{4}$ of $\frac{1}{3}$ of my money, $\frac{1}{3} - \frac{1}{12}$, or, $\frac{1}{4}$ remains.

5. Sum of fractions $= 5\frac{1}{3} + 5\frac{1}{4} = 10\frac{7}{12}$, difference of fractions $= 5\frac{1}{3} - 5\frac{1}{4} = \frac{1}{12}$;

∴ product $= 10\frac{7}{12} \times \frac{1}{12} = \frac{127}{144}$, quotient $= 10\frac{7}{12} \div \frac{1}{12} = 127$;

∴ quotient is 144 times as great as product.

V.

1. $\frac{2+3}{4+5} \div \frac{4+3\frac{1}{2}}{5+5\frac{1}{2}} = \frac{5}{9} \div \frac{7\frac{1}{2}}{10\frac{1}{2}} = \frac{5}{9} \div \frac{15}{21} = \frac{5}{9} \times \frac{7}{5} = \frac{7}{9}.$

Sum of $\frac{1}{2}$, $1\frac{3}{7}$, and $\frac{5}{6}$

$$= 1 + \frac{1}{2} + \frac{3}{7} + \frac{5}{6} = 1 + \frac{21+18+35}{42} = 1 + \frac{74}{42} = 1 + \frac{37}{21} = \frac{58}{21},$$

difference of $\frac{4}{15}$ and $\frac{3}{20} = \frac{16-9}{60} = \frac{7}{60}$; $\therefore$ product $= \frac{58}{21} \times \frac{7}{60} = \frac{29}{90}$;

$\therefore$ quotient $= \frac{29}{90} \div \frac{11}{18}$ of $1\frac{14}{15} = \frac{29}{90} \times \frac{18}{11} \times \frac{15}{29} = \frac{3}{11}.$

2. (1) $\left(\frac{5}{2} - \frac{2}{5}\right) \div \left(\frac{4}{3} - \frac{3}{4}\right) = \frac{25-4}{10} \div \frac{16-9}{12} = \frac{21}{10} \times \frac{12}{7} = \frac{3 \times 6}{5} = \frac{18}{5} = 3\frac{3}{5}.$

(2) $$\frac{\frac{41}{162} - \frac{9}{49} - \frac{3}{54}}{\frac{4}{9} + \frac{1}{2} - \frac{13}{14}} = \frac{\frac{41}{162} - \frac{9}{49} - \frac{9}{162}}{\frac{4}{9} + \frac{7}{14} - \frac{13}{14}} = \frac{\frac{32}{162} - \frac{9}{49}}{\frac{4}{9} - \frac{6}{14}} = \frac{\frac{16}{81} - \frac{9}{49}}{\frac{4}{9} - \frac{3}{7}} = \frac{\frac{784-729}{81 \times 49}}{\frac{28-27}{9 \times 7}}$$

$$= \frac{55 \times 9 \times 7}{81 \times 49} = \frac{55}{9 \times 7} = \frac{55}{63}.$$

(3) $\frac{2}{5}$ of $\frac{13}{16} - \frac{1\frac{2}{3}}{6\frac{2}{3}}$ of $\frac{19}{20} + \frac{3}{7}$ of $\frac{6\frac{5}{12}}{3\frac{2}{3}}$

$$= \frac{13}{40} - \frac{1}{4} \text{ of } \frac{19}{20} + \frac{3}{7} \text{ of } \frac{7}{4} = \frac{13}{40} - \frac{19}{80} + \frac{3}{4} = \frac{26-19+60}{80} = \frac{67}{80}.$$

(4) $$\frac{\frac{3}{5}}{\frac{8}{9}} + \frac{\frac{5}{8}}{2\frac{1}{2} \times 1\frac{1}{3}} \times \frac{1}{80} = \frac{3}{5} \times \frac{9}{8} + \frac{5}{8} \times \frac{2}{5} \times \frac{3}{4} \times \frac{1}{80}$$

$$= \frac{27}{40} + \frac{3}{1280} = \frac{864+3}{1280} = \frac{867}{1280}.$$

(5) $$2\frac{1}{2} \times \frac{1}{3\frac{1}{3} + \frac{1}{4\frac{1}{4}}} = \frac{5}{2} \times \frac{1}{\frac{10}{3} + \frac{4}{17}} = \frac{5}{2} \times \frac{3 \times 17}{170+12} = \frac{5 \times 3 \times 17}{2 \times 182} = \frac{255}{364}.$$

(6) $$\frac{\frac{5}{7}\text{ of }\frac{3}{10}+\frac{1}{4}\text{ of }\frac{8}{21}}{\frac{2}{3}\text{ of }\frac{9}{14}-\frac{5}{6}\text{ of }\frac{2}{15}}=\frac{\frac{3}{14}+\frac{2}{21}}{\frac{3}{7}-\frac{1}{9}}=\frac{\frac{9+4}{42}}{\frac{27-7}{63}}=\frac{13}{42}\times\frac{63}{20}=\frac{13\times3}{2\times20}=\frac{39}{40}.$$

(7) $$\frac{11\frac{5}{7}-7\frac{5}{11}}{3\frac{1}{2}+5\frac{5}{22}}=\frac{4\frac{20}{77}}{8\frac{16}{22}}=\frac{328}{77}\times\frac{22}{192}=\frac{8\times41\times2\times11}{7\times11\times8\times2\times12}=\frac{41}{84}.$$

3. Sum of $\frac{3}{4}$, $\frac{7}{6}$ and $\frac{29}{12}=\frac{9}{12}+\frac{14}{12}+\frac{29}{12}=\frac{52}{12}=4\frac{1}{3}$;

$\therefore$ $\frac{2}{3}$ is the fraction required.

4. $\frac{3}{8}$, $\frac{5}{12}$, $\frac{4}{9}$, $\frac{7}{20}$, are equivalent to $\frac{135}{360}$, $\frac{150}{360}$, $\frac{160}{360}$, $\frac{126}{360}$;

$\therefore$ sum of the greatest and least $=\frac{286}{360}$, sum of the other two $=\frac{285}{360}$;

$\therefore$ difference $=\frac{1}{360}$.

5. The man gives away $\frac{1}{2}$ of $\frac{3}{8}$ or $\frac{3}{16}$; $\therefore$ he has left $\frac{3}{8}-\frac{3}{16}=\frac{6}{16}-\frac{3}{16}=\frac{3}{16}$.

VI.

2. (1) $$\frac{4}{5}\text{ of }\frac{1}{2}-\frac{2}{3}\text{ of }\frac{9}{17}+\frac{3}{5}\text{ of }1\frac{10}{17}=\frac{2}{5}-\frac{18}{51}+\frac{81}{85}$$
$$=\frac{2\times51-18\times5+81\times3}{255}=\frac{102-90+243}{255}=\frac{255}{255}=1.$$

(2) $$\frac{2\frac{3}{4}+3\frac{2}{5}}{4\frac{1}{5}+5\frac{1}{4}}+\frac{3\frac{2}{3}}{10\frac{1}{2}}=\frac{5\frac{23}{20}}{9\frac{9}{20}}+\frac{3\frac{2}{3}}{10\frac{1}{2}}$$
$$=\frac{123}{189}+\frac{11\times2}{21\times3}=\frac{41}{63}+\frac{22}{63}=\frac{63}{63}=1.$$

(3) $$\left\{\frac{5}{7}\times\frac{2}{9}\times13\frac{1}{2}\right\}\div\left\{\frac{1}{9}\times\frac{3}{7}+40\right\}$$
$$=\left\{\frac{5\times2\times27}{7\times9\times2}\right\}\div\left\{\frac{1+840}{21}\right\}=\frac{15}{7}\times\frac{21}{841}=\frac{45}{841}.$$

(4) $$\frac{2\frac{4}{11}}{2\frac{3}{5}}\div\frac{2\frac{7}{11}}{8\frac{7}{10}}=\left(\frac{26}{11}\times\frac{5}{13}\right)\div\left(\frac{29}{11}\times\frac{10}{87}\right)=\frac{2\times5}{11}\times\frac{11\times3}{10}=3.$$

3. $\frac{2}{3}$ of $\frac{5}{9}$ of $\frac{81}{141}$ of $1\frac{1}{5}=\frac{2\times5\times9\times3\times3\times2\times3}{3\times9\times3\times47\times5}=\frac{2\times2\times3}{47}=\frac{12}{47}$.

5. $3\frac{1}{9}\times3\frac{1}{10}=\frac{28}{9}\times\frac{31}{10}=\frac{14\times31}{9\times5}=\frac{434}{45}$; $\frac{20\frac{3}{4}}{3}\div\frac{41\frac{1}{2}}{4}=\frac{83}{12}\times\frac{8}{83}=\frac{2}{3}$;

$\therefore$ sum of fractions $=\frac{434}{45}+\frac{30}{45}=\frac{464}{45}$,

difference of fractions $=\frac{434}{45}-\frac{30}{45}=\frac{404}{45}$,

difference of these results $=\frac{60}{45}=\frac{4}{3}=1\frac{1}{3}$.

6. Number $=3\frac{227}{420}-\frac{31}{35}-\frac{10}{21}=\frac{1487}{420}-\frac{372}{420}-\frac{200}{420}=\frac{915}{420}=\frac{61}{28}=2\frac{5}{28}$,

and number $=\frac{4}{15}\times2\frac{1}{16}=\frac{4}{15}\times\frac{33}{16}=\frac{11}{20}$.

VII.

2. (1) $$\frac{\frac{3}{4}}{\frac{5}{4}}+\frac{2\frac{1}{4}-\frac{3}{7}}{5\frac{1}{4}+\frac{1}{14}}-\frac{2}{3\frac{4}{7}}=\frac{3}{5}+\frac{1\frac{23}{28}}{5\frac{9}{28}}-\frac{2\times7}{25}=\frac{3}{5}+\frac{51}{149}-\frac{14}{25}$$

$$=\frac{15}{25}+\frac{51}{149}-\frac{14}{25}=\frac{1}{25}+\frac{51}{149}=\frac{149+1275}{3725}=\frac{1424}{3725}.$$

(2) $$2\frac{1}{6}+3\frac{3}{8}+\frac{9}{14}+\frac{1}{15}+6\frac{17}{20}=11+\frac{1}{6}+\frac{3}{8}+\frac{9}{14}+\frac{1}{15}+\frac{17}{20}$$

$$=11+\frac{10}{60}+\frac{21}{56}+\frac{36}{56}+\frac{4}{60}+\frac{51}{60}=11+\frac{65}{60}+\frac{57}{56}$$

$$=13+\frac{1}{12}+\frac{1}{56}=13+\frac{14+3}{168}=13\frac{17}{168}.$$

(3) $$\left(3\frac{1}{4}\text{ of }4\frac{1}{3}\right)\div\left(2\frac{1}{2}-\frac{1}{3}\right)\text{ of }\left(3\frac{1}{2}-\frac{1}{4}\right)$$

$$=\frac{13}{4}\times\frac{13}{3}\div2\frac{1}{6}\text{ of }3\frac{1}{4}=\frac{13\times13}{4\times3}\times\frac{6}{13}\times\frac{4}{13}=\frac{6}{3}=2.$$

(4) $\left(\frac{1}{26}\text{ of }3\frac{1}{4}\right)+\left(\frac{3}{8}\div\frac{27}{64}\right)-\left(\frac{1}{1\frac{1}{7}}-\frac{1\frac{1}{3}}{3}\right)\div\left(2-\frac{5}{9}\right)$

$$=\frac{1}{8}+\frac{8}{9}-\left(\frac{7}{8}-\frac{4}{9}\right)\div\frac{13}{9}=\frac{1}{8}+\frac{8}{9}-\frac{63-32}{8\times 9}\times\frac{9}{13}$$

$$=\frac{1}{8}+\frac{8}{9}-\frac{31}{8\times 13}=\frac{9\times 13+8\times 8\times 13-31\times 9}{9\times 8\times 13}$$

$$=\frac{117+832-279}{936}=\frac{670}{936}=\frac{335}{468}.$$

3. $\dfrac{\frac{2}{3}\text{ of }\frac{5}{7}\text{ of }\frac{35}{9}}{\frac{1}{7}\text{ of }\frac{2}{3}\text{ of }\frac{84}{81}}=\dfrac{2\times 5\times 5}{3\times 9}\times\dfrac{7\times 3\times 9\times 9}{2\times 2\times 7\times 6}=\dfrac{5\times 5\times 9}{2\times 6}=\dfrac{75}{4},$

sum of $10\frac{3}{4}+3\frac{9}{10}+7\frac{24}{25}$

$$=20+\frac{75}{100}+\frac{90}{100}+\frac{96}{100}=20+\frac{261}{100}=\frac{2261}{100};$$

$\therefore$ difference required $=\dfrac{2261}{100}-\dfrac{75}{4}=\dfrac{2261-1875}{100}=\dfrac{386}{100}=3\frac{43}{50}.$

4. $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}=\frac{30+20+15+12}{60}=\frac{77}{60},\ 2-\frac{77}{60}=\frac{120-77}{60}=\frac{43}{60},$

$\frac{43}{60}\times\frac{2}{3}\text{ of }\frac{27}{40}\text{ of }8=\frac{43\times 2\times 3\times 3\times 3\times 8}{3\times 2\times 10\times 3\times 8\times 5}=\frac{129}{50};$

$\therefore$ fraction required $=\dfrac{\frac{129}{50}}{\frac{99}{1}}=\dfrac{129}{50\times 99}=\dfrac{43}{1650}.$

5. Whole no. $-\left(\frac{1}{8}+\frac{2}{10}+\frac{3}{20}\right)$ of no. $\neq 126$;

$\therefore$ whole no. $-\frac{19}{40}$ of no. $=126$;

$\therefore\ \frac{21}{40}$ of no. $=126$; $\therefore\ \frac{1}{40}$ of no. $=6$; $\therefore$ no. $=240$;

therefore, one obtained 30; two others, each 24; three others, each 12. Also by question, 21 no. scored by last $=126$; therefore, no. scored by him $=6$; therefore, no. scored by the remaining four, each $=30$.

DECIMALS.

Ex. XXIV. (p. 61.)

1. $\frac{1}{10}$; $\frac{3}{10}$; $\frac{31}{100}$; $\frac{311}{1000}$; $\frac{31111}{100000}$; $\frac{31111111}{100000000}$.

2. ${\cdot}5=\frac{5}{10}=\frac{1}{2}$; ${\cdot}25=\frac{25}{100}=\frac{1}{4}$; ${\cdot}35=\frac{35}{100}=\frac{7}{20}$; ${\cdot}05=\frac{5}{100}=\frac{1}{20}$;

${\cdot}005=\frac{5}{1000}=\frac{1}{200}$; ${\cdot}256=\frac{256}{1000}=\frac{32}{125}$; ${\cdot}0256=\frac{256}{10000}=\frac{16}{625}$;

${\cdot}000256=\frac{256}{1000000}=\frac{4}{15625}$; ${\cdot}00008125=\frac{8125}{100000000}=\frac{13}{160000}$.

3. ${\cdot}075=\frac{75}{1000}=\frac{15}{200}=\frac{3}{40}$; ${\cdot}848=\frac{848}{1000}=\frac{212}{250}=\frac{106}{125}$;

$3{\cdot}02=\frac{302}{100}=\frac{151}{50}$; $3{\cdot}434=\frac{3434}{1000}=\frac{1717}{500}$; $343{\cdot}4=\frac{3434}{10}=\frac{1717}{5}$;

${\cdot}03434=\frac{3434}{100000}=\frac{1717}{50000}$; ${\cdot}050005=\frac{50005}{1000000}=\frac{10001}{200000}$;

$230{\cdot}409=\frac{230409}{1000}$; $2{\cdot}30409=\frac{230409}{100000}$; $2137{\cdot}2=\frac{21372}{10}=\frac{10686}{5}$;

$91300{\cdot}0008=\frac{913000008}{10000}=\frac{456500004}{5000}=\frac{114125001}{1250}$;

$24{\cdot}000625=\frac{24000625}{1000000}=\frac{4800125}{200000}=\frac{960025}{40000}=\frac{192005}{8000}=\frac{38401}{1600}$;

$8213{\cdot}7169125=\frac{82137169125}{10000000}=\frac{16427433825}{2000000}=\frac{3285486765}{400000}=\frac{657097353}{80000}$;

${\cdot}00083276=\frac{83276}{100000000}=\frac{20819}{25000000}$;

$1{\cdot}0000009=\frac{10000009}{10000000}$; ${\cdot}000000001=\frac{1}{1000000000}$.

4. ·1; ·3; ·7; ·53; ·07; ·008; ·9178; 91·78; ·09178; ·0091; ·00009; 520·3; ·9; 3·0142; 6·72819; ·000672819; 6728·19.

5. ${\cdot}7\times10=\frac{7}{10}\times10=7$; ${\cdot}7\times100=\frac{7}{10}\times100=70$;

${\cdot}7\times1000=\frac{7}{10}\times1000=700$; ${\cdot}7\times100000=\frac{7}{10}\times100000=70000$;

$$\cdot006 \times 100 = \frac{6}{1000} \times 100 = \frac{6}{10} = \cdot6; \quad \cdot006 \times 10000 = \frac{6}{1000} \times 10000 = 60;$$

$$\cdot006 \times 10000000 = \frac{6}{1000} \times 10000000 = 60000;$$

$$\cdot0431 \times 100 = \frac{431}{10000} \times 100 = \frac{431}{100} = 4\cdot31;$$

$$\cdot0431 \times 1000000 = \frac{431}{10000} \times 1000000 = 43100;$$

$$16\cdot201 \times 10 = \frac{16201}{1000} \times 10 = 162\cdot01;$$

$$16\cdot201 \times 1000 = \frac{16201}{1000} \times 1000 = 16201;$$

$$16\cdot201 \times 1000000 = \frac{16201}{1000} \times 1000000 = 16201000;$$

$$9\cdot0016 \times 1000000 = \frac{90016}{10000} \times 1000000 = 9001600;$$

$$9\cdot0016 \times 100 = \frac{90016}{10000} \times 100 = 900\cdot16.$$

6. $$\cdot51 \div 10 = \frac{51}{100} \times \frac{1}{10} = \frac{51}{1000} = \cdot051;$$

$$\cdot51 \div 1000 = \frac{51}{100} \times \frac{1}{1000} = \frac{51}{100000} = \cdot00051;$$

$$\cdot51 \div 100000 = \frac{51}{100} \times \frac{1}{100000} = \frac{51}{10000000} = \cdot0000051;$$

$$\cdot008 \div 100 = \frac{8}{1000} \times \frac{1}{100} = \frac{8}{100000} = \cdot00008;$$

$$\cdot008 \div 1000000 = \frac{8}{1000} \times \frac{1}{1000000} = \frac{8}{1000000000} = \cdot000000008;$$

$$5\cdot016 \div 1000 = \frac{5016}{1000} \times \frac{1}{1000} = \frac{5016}{1000000} = \cdot005016;$$

$$5\cdot016 \div 100000 = \frac{5016}{1000} \times \frac{1}{100000} = \frac{5016}{100000000} = \cdot00005016;$$

$$378\cdot0186 \div 1000 = \frac{3780186}{10000} \times \frac{1}{1000} = \frac{3780186}{10000000} = \cdot3780186;$$

$$378\cdot0186 \div 1000000 = \frac{3780186}{10000} \times \frac{1}{1000000} = \frac{3780186}{10000000000} = \cdot0003780186;$$

7. ·5; ·7; ·19; ·28; ·005; 9·7; ·000001; 14·4; 280·0004; 7·007; 100·00001; 1·0010001; ·000000000005.

8. Four-tenths; twenty-five hundredths; seventy-five hundredths; seven hundred and forty-five thousandths; one-tenth; one thousandth; one hundred thousandth; twenty-three and seventy-five hundredths; two and three hundred and seventy-five thousandths; two thousand three hundred and seventy-five ten thousandths; two thousand three hundred and seventy-five hundred millionths; one and one millionth; one million and one ten millionths; one hundred millionth.

ADDITION OF DECIMALS.

Ex. XXV. (p. 66.)

1. (1)
$$\begin{array}{r} \cdot234 \\ 14\cdot3812 \\ \cdot01 \\ 32\cdot47 \\ \cdot00075 \\ \hline 47\cdot09595 \end{array}$$

(2)
$$\begin{array}{r} 232\cdot15 \\ 3\cdot225 \\ 21\cdot \\ \cdot0001 \\ 34\cdot005 \\ \cdot001304 \\ \hline 290\cdot381404 \end{array}$$

(3)
$$\begin{array}{r} 14\cdot94 \\ \cdot00857 \\ 1\cdot5 \\ 5607\cdot25 \\ 530\cdot \\ \cdot0057 \\ \hline 6153\cdot70427 \end{array}$$

2. (1)
$$\begin{array}{r} \cdot08 \\ 165\cdot \\ 1\cdot327 \\ \cdot0003 \\ 2760\cdot1 \\ 9\cdot \\ \hline 2935\cdot5073 \end{array}$$

(2)
$$\begin{array}{r} 346\cdot \\ \cdot0027 \\ \cdot25 \\ \cdot186 \\ 72\cdot505 \\ \cdot0014 \\ \cdot00004 \\ \hline 418\cdot94514 \end{array}$$

(3)
$$\begin{array}{r} 6\cdot3084 \\ \cdot006 \\ 36\cdot207 \\ \cdot0001 \\ 364\cdot \\ \cdot008022 \\ \hline 406\cdot529522 \end{array}$$

(4)
$$\begin{array}{r} 725\cdot1201 \\ 34\cdot00076 \\ \cdot04 \\ 50\cdot9 \\ 143\cdot713 \\ \hline 953\cdot77386 \end{array}$$

(5)
$$\begin{array}{r} 67\cdot8125 \\ 27\cdot105 \\ 17\cdot5 \\ \cdot000375 \\ 255\cdot \\ 3\cdot0125 \\ \hline 370\cdot430375 \end{array}$$

3. (1)
$$\begin{array}{r} 2\cdot0068 \\ \cdot04137 \\ \cdot987641 \\ 1\cdot0000009 \\ 57\cdot \\ 1\cdot5 \\ \hline 62\cdot5358119 \end{array}$$

$2\cdot0068 + \cdot04137 + \cdot987641 + 1\cdot0000009 + 57 + 1\cdot5$

$$=\frac{20068}{10000}+\frac{4137}{100000}+\frac{987641}{1000000}+\frac{10000009}{10000000}+\frac{57}{1}+\frac{15}{10}$$

$$=\frac{20068000}{10000000}+\frac{413700}{10000000}+\frac{9876410}{10000000}+\frac{10000009}{10000000}+\frac{570000000}{10000000}+\frac{15000000}{10000000}$$

$$=\frac{625358119}{10000000}=62\cdot5358119.$$

(2)
$$\begin{array}{r@{\cdot}l}
 & 0003025 \\
29 & 99987 \\
143 & 2 \\
5 & 000025 \\
9000 & \\
3 & 4073 \\
\hline
9181 & 6074975
\end{array}$$

$\cdot0003025 + 29\cdot99987 + 143\cdot2 + 5\cdot000025 + 9000 + 3\cdot4073$

$$=\frac{3025}{10000000}+\frac{2999987}{100000}+\frac{1432}{10}+\frac{5000025}{1000000}+\frac{9000}{1}+\frac{34073}{10000}$$

$$=\frac{3025}{10000000}+\frac{299998700}{10000000}+\frac{1432000000}{10000000}+\frac{50000250}{10000000}+\frac{90000000000}{10000000}+\frac{34073000}{10000000}$$

$$=\frac{91816074975}{10000000}=9181\cdot6074975.$$

(3)
$$\begin{array}{r@{\cdot}l}
21 & 74 \\
 & 075 \\
103 & 00375 \\
 & 0005495 \\
4957 & 5 \\
\hline
5082 & 3192995
\end{array}$$

$21\cdot74 + \cdot075 + 103\cdot00375 + \cdot0005495 + 4957\cdot5$

$$=\frac{2174}{100}+\frac{75}{1000}+\frac{10300375}{100000}+\frac{5495}{10000000}+\frac{49575}{10}$$

$$=\frac{217400000}{10000000}+\frac{750000}{10000000}+\frac{1030037500}{10000000}+\frac{5495}{10000000}+\frac{49575000000}{10000000}$$

$$=\frac{50823192995}{10000000}$$

$=5082\cdot3192995.$

(4)
$$\begin{array}{r@{\cdot}l}
500 & 09 \\
375 & \\
20084 & 00078 \\
11002000 & 000209 \\
 & 000000011 \\
10000000000000 & 000000000001 \\
\hline
10000011022959 & 090989011001
\end{array}$$

SUBTRACTION OF DECIMALS.

Ex. XXVI. (p. 67.)

1.

$$\begin{array}{r} 2{\cdot}1354 \\ 1{\cdot}0436 \\ \hline 1{\cdot}0918 \end{array} \qquad \begin{array}{r} 7{\cdot}835 \\ 2{\cdot}0005 \\ \hline 5{\cdot}8345 \end{array} \qquad \begin{array}{r} 156{\cdot}7 \\ 15{\cdot}67 \\ \hline 141{\cdot}03 \end{array} \qquad \begin{array}{r} {\cdot}001 \\ {\cdot}0009 \\ \hline {\cdot}0001 \end{array} \qquad \begin{array}{r} {\cdot}305 \\ {\cdot}000683 \\ \hline {\cdot}304317 \end{array}$$

2.

$$(1)\ \begin{array}{r} 213{\cdot}5 \\ 1{\cdot}8125 \\ \hline 211{\cdot}6875 \end{array} \qquad (2)\ \begin{array}{r} {\cdot}0516 \\ {\cdot}0094187 \\ \hline {\cdot}0421813 \end{array} \qquad (3)\ \begin{array}{r} 603{\cdot} \\ {\cdot}6584003 \\ \hline 602{\cdot}3415997 \end{array}$$

$$(4)\ \begin{array}{r} 17{\cdot}5 \\ 13{\cdot}0046 \\ \hline 4{\cdot}4954 \end{array} \qquad (5)\ \begin{array}{r} {\cdot}582 \\ {\cdot}09647 \\ \hline {\cdot}48553 \end{array} \qquad (6)\ \begin{array}{r} 9{\cdot}233 \\ {\cdot}0536 \\ \hline 9{\cdot}1794 \end{array}$$

3.

$$\begin{array}{r} {\cdot}1 \\ {\cdot}01 \\ \hline {\cdot}09 \end{array} \qquad \text{or } {\cdot}1-{\cdot}01=\frac{1}{10}-\frac{1}{100}$$

$$=\frac{9}{100}={\cdot}09$$

$$\begin{array}{r} 713{\cdot}00683 \\ 57{\cdot}704 \\ \hline 655{\cdot}30283 \end{array} \qquad \text{or } 713{\cdot}00683-57{\cdot}704$$

$$=\frac{71300683}{100000}-\frac{57704}{1000}$$

$$=\frac{71300683-5770400}{100000}$$

$$=\frac{65530283}{100000}=655{\cdot}30283$$

$$\begin{array}{r} 56{\cdot}078 \\ 35{\cdot}009876 \\ \hline 21{\cdot}068124 \end{array} \qquad \text{or } \frac{56078}{1000}-\frac{35009876}{1000000}=\frac{56078000-35009876}{1000000}$$

$$=\frac{21068124}{1000000}=21{\cdot}068124$$

$$\begin{array}{r} 9816{\cdot} \\ 27{\cdot}148 \\ \hline 9788{\cdot}852 \end{array} \qquad \text{or } 9816-\frac{27148}{1000}=\frac{9816000-27148}{1000}$$

$$=\frac{9788852}{1000}=9788{\cdot}852.$$

4.

$$\begin{array}{r} 7{\cdot} \\ {\cdot}7 \\ \hline 6{\cdot}3 \end{array} \qquad \text{or } 7-\frac{7}{10}=\frac{70-7}{10}=\frac{63}{10}=6{\cdot}3.$$

$$\begin{array}{r} {\cdot}7 \\ {\cdot}000007 \\ \hline {\cdot}699993 \end{array} \qquad \text{or} \quad \frac{7}{10}-\frac{7}{1000000}=\frac{700000-7}{1000000}=\frac{699993}{1000000}={\cdot}699993$$

$$\begin{array}{r} 174{\cdot}01 \\ 74{\cdot}304 \\ \hline 99{\cdot}706 \end{array} \qquad \text{or} \quad \frac{17401}{100}-\frac{74304}{1000}=\frac{174010-74304}{1000}=\frac{99706}{1000}=99{\cdot}706.$$

MULTIPLICATION OF DECIMALS.

Ex. XXVII. (p. 68.)

1. (1)

$$\begin{array}{r} 3{\cdot}8 \\ 42 \\ \hline 76 \\ 152 \\ \hline 159{\cdot}6 \end{array} \qquad \begin{array}{r} {\cdot}38 \\ {\cdot}42 \\ \hline 76 \\ 152 \\ \hline {\cdot}1596 \end{array} \qquad \begin{array}{r} 3{\cdot}8 \\ 4{\cdot}2 \\ \hline 76 \\ 152 \\ \hline 15{\cdot}96 \end{array} \qquad \begin{array}{r} {\cdot}038 \\ {\cdot}0042 \\ \hline 76 \\ 152 \\ \hline {\cdot}0001596 \end{array}$$

(2)

$$\begin{array}{r} 417 \\ {\cdot}417 \\ \hline 2919 \\ 417 \\ 1668 \\ \hline 173{\cdot}889 \end{array} \qquad \begin{array}{r} {\cdot}417 \\ {\cdot}417 \\ \hline {\cdot}173889 \end{array} \qquad \begin{array}{r} 71956 \\ {\cdot}000025 \\ \hline 359780 \\ 143912 \\ \hline 1{\cdot}798900 \end{array}$$

(3)

$$\begin{array}{r} 2{\cdot}052 \\ {\cdot}0031 \\ \hline 2052 \\ 6156 \\ \hline {\cdot}0063612 \end{array} \qquad \begin{array}{r} {\cdot}916 \\ 4{\cdot}07 \\ \hline 6412 \\ 3664 \\ \hline 3{\cdot}72812 \end{array} \qquad \begin{array}{r} 476 \\ {\cdot}00026 \\ \hline 2856 \\ 952 \\ \hline {\cdot}12376 \end{array}$$

2. (1)

$$\begin{array}{r} 81{\cdot}4632 \\ {\cdot}0378 \\ \hline 6517056 \\ 5702424 \\ 2443896 \\ \hline 3{\cdot}07930896 \end{array} \qquad \text{or } 81{\cdot}4632\times{\cdot}0378 = \frac{814632}{10000}\times\frac{378}{10000} = \frac{307930896}{100000000}=3{\cdot}07930896.$$

(2)

$$\begin{array}{r} 27{\cdot}35 \\ 7{\cdot}70071 \\ \hline 2735 \\ 19145 \\ 19145 \\ 19145 \\ \hline 210{\cdot}6144185 \end{array} \qquad \text{or } 27{\cdot}35\times 7{\cdot}70071 = \frac{2735}{100}\times\frac{770071}{100000} = \frac{2106144185}{10000000}=210{\cdot}6144185.$$

(3)

$$\begin{array}{r} \cdot04375\\ \cdot0754\\ \hline 17500\\ 21875\\ 30625\\ \hline \cdot003298750 \end{array}$$

or $\cdot04375\times\cdot0754$

$$=\frac{4375}{100000}\times\frac{754}{10000}$$

$$=\frac{3298750}{1000000000}=\cdot00329875.$$

3. (1)

$$\begin{array}{r} \cdot0046\\ 7\cdot85\\ \hline 230\\ 368\\ 322\\ \hline \cdot036110 \end{array}$$

or $\cdot0046\times7\cdot85$

$$=\frac{46}{10000}\times\frac{785}{100}$$

$$=\frac{36110}{1000000}=\cdot03611.$$

(2)

$$\begin{array}{r} \cdot00846\\ \cdot00324\\ \hline 3384\\ 1692\\ 2538\\ \hline \cdot0000274104 \end{array}$$

or $\cdot00846\times\cdot00324$

$$=\frac{846}{100000}\times\frac{324}{100000}$$

$$=\frac{274104}{10000000000}=\cdot0000274104.$$

(3)

$$\begin{array}{r} \cdot314\\ \cdot0021\\ \hline 314\\ 628\\ \hline \cdot0006594 \end{array}$$

or $\cdot314\times\cdot0021$

$$=\frac{314}{1000}\times\frac{21}{10000}$$

$$=\frac{6594}{10000000}=\cdot0006594.$$

(4)

$$\begin{array}{r} \cdot009\\ \cdot00846\\ \hline 54\\ 36\\ 72\\ \hline \cdot00007614 \end{array}$$

or $\cdot009\times\cdot00846$

$$=\frac{9}{1000}\times\frac{846}{100000}$$

$$=\frac{7614}{100000000}=\cdot00007614.$$

(5)

$$\begin{array}{r} \cdot009207\\ 6\cdot056\\ \hline 55242\\ 46035\\ 55242\\ \hline \cdot055757592 \end{array}$$

or $\cdot009207\times6\cdot056$

$$=\frac{9207}{1000000}\times\frac{6056}{1000}$$

$$=\frac{55757592}{1000000000}=\cdot055757592.$$

(6)

$$\begin{array}{r} \cdot00948\\ 29\\ \hline 8532\\ 1896\\ \hline \cdot27492 \end{array}$$

or $\cdot00948\times29$

$$=\frac{948}{100000}\times\frac{29}{1}$$

$$=\frac{27492}{100000}=\cdot27492.$$

4.

$$\begin{array}{r} 1 \\ \cdot01 \\ \hline \cdot01 \\ \cdot001 \\ \hline \cdot00001 \\ 100 \\ \hline \cdot00100 \end{array}$$

or $1\times\cdot01\times\cdot001\times100$

$$=1\times\frac{1}{100}\times\frac{1}{1000}\times100$$

$$=\frac{100}{100000}=\frac{1}{1000}=\cdot001.$$

$$\begin{array}{r} \cdot12 \\ 1\cdot2 \\ \hline \cdot144 \\ \cdot012 \\ \hline \cdot001728 \\ 120 \\ \hline \cdot207360 \end{array}$$

or $\cdot12\times1\cdot2\times\cdot012\times120$

$$=\frac{12}{100}\times\frac{12}{10}\times\frac{12}{1000}\times\frac{120}{1}$$

$$=\frac{207360}{1000000}=\cdot20736.$$

5. (1)

$$\begin{array}{r} 7\cdot6 \\ \cdot071 \\ \hline 76 \\ 532 \\ \hline \cdot5396 \\ 2\cdot1 \\ \hline 5396 \\ 10792 \\ \hline 1\cdot13316 \\ 29 \\ \hline 1019844 \\ 226632 \\ \hline 32\cdot86164 \end{array}$$

(2)

$$\begin{array}{r} \cdot007 \\ 700 \\ \hline 4\cdot900 \\ 760\cdot3 \\ \hline 147 \\ 294 \\ 343 \\ \hline 3725\cdot47 \\ \cdot00416 \\ \hline 2235282 \\ 372547 \\ 1490188 \\ \hline 15\cdot4979552 \\ 100000 \\ \hline 1549795\cdot52 \end{array}$$

DIVISION OF DECIMALS.

Ex. XXVIII. (p. 72.)

1. (1)

$$\begin{array}{r} 5\cdot16)\,10\cdot836\,(2\cdot1 \\ 1032 \\ \hline 516 \\ 516 \\ \hline \end{array}$$

$$10\cdot836\div5\cdot16=\frac{10836}{1000}\times\frac{100}{516}=\frac{10836}{516}\times\frac{1}{10}=\frac{21}{10}=2\cdot1.$$

·381) 34·96818 (91·78
34 29
678
381
2971
2667
3048
3048

$$34{\cdot}96818 \div {\cdot}381 = \frac{3496818}{100000} \times \frac{1000}{381} = \frac{3496818}{381} \times \frac{1}{100} = \frac{9178}{100} = 91{\cdot}78.$$

(2) 1·003) ·025075 (·025
2006
5015
5015

$${\cdot}025075 \div 1{\cdot}003 = \frac{25075}{1000000} \times \frac{1000}{1003} = \frac{25075}{1003} \times \frac{1}{1000} = \frac{25}{1000} = {\cdot}025.$$

·0012) ·02916 (24·3
24
51
48
36
36

$${\cdot}02916 \div {\cdot}0012 = \frac{2916}{100000} \times \frac{10000}{12} = \frac{2916}{12} \times \frac{1}{10} = \frac{243}{10} = 24{\cdot}3.$$

(3) 27) ·00081 (·00003
81

$${\cdot}00081 \div 27 = \frac{81}{100000} \times \frac{1}{27} = \frac{3}{100000} = {\cdot}00003.$$

4·735) 1·770890 (·374
1 4205
35039
33145
18940
18940

$$1{\cdot}77089 \div 4{\cdot}735 = \frac{177089}{100000} \times \frac{1000}{4735} = \frac{1770890}{4735} \times \frac{1}{1000} = \frac{374}{1000} = {\cdot}374.$$

(4) ·1) 1·0 (10
10

$$1 \div {\cdot}1 = 1 \times \frac{10}{1} = 10.$$

·01) 1·00 (100
100

$$1 \div \cdot 01 = 1 \times \frac{100}{1} = 100.$$

·0001) 1·0000 (10000
10000

$$1 \div \cdot 0001 = 1 \times \frac{10000}{1} = 10000.$$

(5)

·126) 31·500 (250
252
630
630

$$31\cdot 5 \div \cdot 126 = \frac{315}{10} \times \frac{1000}{126} = \frac{31500}{126} = 250.$$

·32) 5·2000 (16·25
32
200
192
80
64
160
160

$$5\cdot 2 \div \cdot 32 = \frac{52}{10} \times \frac{100}{32}$$

$$= \frac{52000}{32} \times \frac{1}{100} = \frac{1625}{100} = 16\cdot 25.$$

(6) ·0625) 3217·0000 (51472
3125
920
625
2950
2500
4500
4375
1250
1250

$$3217 \div \cdot 0625$$

$$= \frac{3217 \times 10000}{625}$$

$$= \frac{32170000}{625}$$

$$= 51472.$$

6250) ·0321700000 (·0000051472

$$\cdot 03217 \div 6250 = \frac{3217}{100000} \times \frac{1}{6250} = \frac{32170000}{625} \times \frac{1}{10000000000}$$

$$= \frac{51472}{10000000000} = \cdot 0000051472.$$

(7)

81·34) 4·63638 (·057
40670
56938
56938

$$4\cdot 63638 \div 81\cdot 34 = \frac{463638}{100000} \times \frac{100}{8134} = \frac{57}{1000} = \cdot 057.$$

·019) 15·4546 (813·4
152
25
19
64
57
76
76

$$\therefore\ 15\cdot4546\div\cdot019=\frac{154546}{10000}\times\frac{1000}{19}=\frac{8134}{10}=813\cdot4.$$

(8) 59·64) ·429408 (·0072
41748
11928
11928

$$\cdot429408\div59\cdot64=\frac{429408}{1000000}\times\frac{100}{5964}=\frac{72}{10000}=\cdot0072.$$

·036) 2147·040 (59640
180
347
324
230
216
144
144

$$2147\cdot04\div\cdot036=\frac{214704}{100}\times\frac{1000}{36}=\frac{2147040}{36}=59640.$$

(9) ·0012) 12·6000 (10500
12
60
60

$$12\cdot6\div\cdot0012=\frac{126}{10}\times\frac{10000}{12}=\frac{126000}{12}=10500.$$

·000475) ·06534100 (137·56
475
1784
1425
3591
3325
2660
2375
2850
2850

$$\cdot065341\div\cdot000475=\frac{65341}{1000000}\times\frac{1000000}{475}=\frac{6534100}{475}\times\frac{1}{100}=\frac{13756}{100}=137\cdot56.$$

(10) ·0006) 3·0120 (5020

$$3\cdot012\div\cdot0006=\frac{3012}{1000}\times\frac{10000}{6}=\frac{30120}{6}=5020.$$

541·283) 293916·669 (543
2706415
2327516
2165132
1623849
1623849

$$293916·669 \div 541·283 = \frac{293916669}{1000} \times \frac{1000}{541283} = 543.$$

(11) ·0004) 130·4000 (326000

$$130·4 \div ·0004 = \frac{1304}{10} \times \frac{10000}{4} = \frac{1304000}{4} = 326000.$$

4) 130·4 (32·6

$$130·4 \div 4 = \frac{1304}{10} \times \frac{1}{4} = \frac{326}{10} = 32·6.$$

4807·65) 46·634205 (·0097
4326885
3365355
3365355

$$46·634205 \div 4807·65 = \frac{46634205}{1000000} \times \frac{100}{480765} = \frac{97}{10000} = ·0097.$$

(12) 1·3) 1·69 (1·3
13
39
39

$$1·69 \div 1·3 = \frac{169}{100} \times \frac{10}{13} = \frac{13}{10} = 1·3.$$

·13) 1·69 (13

$$1·69 \div ·13 = \frac{169}{100} \times \frac{100}{13} = 13.$$

13) 1·69 (·13

$$1·69 \div 13 = \frac{169}{100} \times \frac{1}{13} = \frac{13}{100} = ·13.$$

·013) 1·690 (130

$$1·69 \div ·013 = \frac{169}{100} \times \frac{1000}{13} = \frac{1690}{13} = 130.$$

(13) 1·405) ·002810 (·002
2810

$$·00281 \div 1·405 = \frac{281}{100000} \times \frac{1000}{1405} = \frac{2810}{1405} \times \frac{1}{1000} = \frac{2}{1000} = ·002.$$

1405) ·002810 (·000002

$$·00281 \div 1405 = \frac{281}{100000} \times \frac{1}{1405} = \frac{2810}{1405} \times \frac{1}{1000000} = \frac{2}{1000000} = ·000002.$$

·001405) ·002810 (2

$$·00281 \div ·001405 = \frac{281}{100000} \times \frac{1000000}{1405} = \frac{2810}{1405} = 2.$$

(14) 36) 72·36 (2·01
72
36
36

$$72{\cdot}36 \div 36 = \frac{7236}{100} \times \frac{1}{36} = \frac{201}{100} = 2{\cdot}01.$$

·0036) 72·3600 (20100

$$72{\cdot}36 \div {\cdot}0036 = \frac{7236}{100} \times \frac{10000}{36} = \frac{723600}{36} = 20100.$$

1·6) ·0030000 (·001875
16
140
128
120
112
80
80

$$\begin{aligned}{\cdot}003 \div 1{\cdot}6 &= \frac{3}{1000} \times \frac{10}{16}\\ &= \frac{30000}{16} \times \frac{1}{1000000}\\ &= \frac{1875}{1000000} = {\cdot}001875.\end{aligned}$$

(15) 7089) 6725402·3544 (948·7096
63801
34530
28356
61742
56712
50303
49623
68054
63801
42534
42534

$$\begin{aligned}&6725402{\cdot}3544 \div 7089\\ &= \frac{67254023544}{10000} \times \frac{1}{7089}\\ &= \frac{9487096}{10000} = 948{\cdot}7096.\end{aligned}$$

·7089) 6725402·3544 (9487096

$$6725402{\cdot}3544 \div {\cdot}7089 = \frac{67254023544}{10000} \times \frac{10000}{7089} = 9487096.$$

(16) 396·25) 10363284·750 (26153·4
79250
243828
237750
60784
39625
211597
198125
134725
118875
158500
158500

$$\begin{aligned}&10363284{\cdot}75 \div 396{\cdot}25\\ &= \frac{1036328475}{100} \times \frac{100}{39625}\\ &= \frac{10363284750}{39625} \times \frac{1}{10}\\ &= \frac{261534}{10} = 26153{\cdot}4.\end{aligned}$$

·0046) ·09844 (21·4
92
64
46
184
184

$$\cdot09844 \div \cdot0046 = \frac{9844}{100000} \times \frac{10000}{46} = \frac{214}{10} = 21\cdot4.$$

(17) ·0004) 816·0000 (2040000

$$816 \div \cdot0004 = \frac{816}{1} \times \frac{10000}{4} = 2040000.$$

2·38645) ·0019610652875 (·00082175
1909160
519052
477290
417628
238645
1789837
1670515
1193225
1193225

$$\cdot0019610652875 \div 2\cdot38645 = \frac{19610652875}{10000000000000} \times \frac{100000}{238645} = \frac{82175}{100000000} = \cdot00082175.$$

(18) 2315) 18368830·5 (7934·7
16205
21638
20835
8033
6945
10880
9260
16205
16205

$$18368830\cdot5 \div 2315 = \frac{183688305}{10} \times \frac{1}{2315} = \frac{79347}{10} = 7934\cdot7.$$

231·5) 18368830·5 (79347

$$18368830\cdot5 \div 231\cdot5 = \frac{183688305}{10} \times \frac{10}{2315} = 79347.$$

·2315) 18368830·5000 (79347000

$$18368830\cdot5 \div \cdot2315 = \frac{183688305}{10} \times \frac{10000}{2315} = \frac{183688305000}{2315} = 79347000.$$

(19) 2·5) ·000050 (·00002
50

$$\cdot00005 \div 2\cdot5 = \frac{5}{100000} \times \frac{10}{25} = \frac{50}{25} \times \frac{1}{100000} = \frac{2}{100000} = \cdot00002.$$

25) ·000050 (·000002

$$\cdot 00005 \div 25 = \frac{5}{100000} \times \frac{1}{25} = \frac{50}{25} \times \frac{1}{1000000} = \frac{2}{1000000} = \cdot 000002.$$

·0000025) ·0000500 (20

$$\cdot 00005 \div \cdot 0000025 = \frac{5}{100000} \times \frac{10000000}{25} = \frac{500}{25} = 20.$$

(20) 1200·21) 684·1197 (·57
600105
840147
840147

$$684\cdot 1197 \div 1200\cdot 21 = \frac{6841197}{10000} \times \frac{100}{120021} = \frac{57}{100} = \cdot 57.$$

·0120021) 684·1197000 (57000

$$684\cdot 1197 \div \cdot 0120021 = \frac{6841197}{10000} \times \frac{10000000}{120021} = \frac{6841197000}{120021} = 57000.$$

2. (1) 8·7) 32·50000 (3·7356
261
640
609
310
261
490
435
550
522
28

$$32\cdot 5 \div 8\cdot 7 = \frac{325}{10} \times \frac{10}{87}$$

$$= \frac{3250000}{87} \times \frac{1}{10000}$$

$$= \frac{37356\ldots.}{10000} = 3\cdot 7356\ldots.$$

1·7) ·02000 (·0117
17
30
17
130
119
11

$$\cdot 02 \div 1\cdot 7 = \frac{2}{100} \times \frac{10}{17}$$

$$= \frac{2000}{17} \times \frac{1}{10000}$$

$$= \frac{117\ldots.}{10000} = \cdot 0117\ldots.$$

·013) 1·0000000 (76·9230
91
90
78
120
117
30
26
40
39
1

$$1 \div \cdot 013 = \frac{1}{1} \times \frac{1000}{13}$$

$$= \frac{10000000}{13} \times \frac{1}{10000}$$

$$= \frac{769230\ldots}{10000} = 76\cdot 9230\ldots.$$

(2) ·0063) ·00938400 (1·4895
63
308
252
564
504
600
567
330
315

$$\cdot009384 \div \cdot0063$$
$$= \frac{9384}{1000000} \times \frac{10000}{63}$$
$$= \frac{938400}{63} \times \frac{1}{10000}$$
$$= \frac{14895\ldots.}{1000} = 1\cdot4895\ldots.$$

1·02) 51846·734000 (50830·1313
510
846
816
307
306
134
102
320
306
140
102
380
306
74

$$51846\cdot734 \div 1\cdot02$$
$$= \frac{51846734}{1000} \times \frac{100}{102}$$
$$= \frac{51846734000}{102} \times \frac{1}{10000}$$
$$= \frac{508301313\ldots.}{10000}$$
$$= 50830\cdot1313\ldots.$$

(3) ·023) 7380·9640000 (320911·4782
69
48
46
209
207
26
23
34
23
110
92
180
161
190
184
60
46
14

$$7380\cdot964 \div \cdot023$$
$$= \frac{7380964}{1000} \times \frac{1000}{23}$$
$$= \frac{73809640000}{23} \times \frac{1}{10000}$$
$$= \frac{3209114782\ldots.}{10000}$$
$$= 320911\cdot4782\ldots.$$

3·42) 6·500000 (1·9005
342
3080
3078
2000
1710

$$6{\cdot}5\div3{\cdot}42=\frac{65}{10}\times\frac{100}{342}$$

$$=\frac{6500000}{342}\times\frac{1}{10000}=1{\cdot}9005\ldots.$$

19) 25·0000 (1·3157
19
60
57
30
19
110
95
150
133

$$25\div19=\frac{250000}{19}\times\frac{1}{10000}$$

$$=\frac{13157\ldots.}{10000}=1{\cdot}3157\ldots.$$

(4) ·01257) 176432·76 (14036019·0930
1257
5073
5028
4527
3771
7566
7542
2400
1257
11430
11313
11700
11313
3870
3771
990

$$176432{\cdot}76\div{\cdot}01257$$

$$=\frac{17643276}{100}\times\frac{100000}{1257}$$

$$=\frac{176432760000000}{1257}\times\frac{1}{10000}$$

$$=\frac{140360190930\ldots.}{10000}$$

$$=14036019{\cdot}0930\ldots.$$

6535496·2) 7457·13450 (·0011
65354962
92163830
65354962

$$7457{\cdot}1345\div6535496{\cdot}2=\frac{74571345}{10000}\times\frac{10}{65354962}$$

$$=\frac{745713450}{65354962}\times\frac{1}{10000}=\frac{11\ldots.}{10000}={\cdot}0011\ldots.$$

(5) 2·9) 37·24000 (12·8413
29
82
58
244
232
120
116
40
29
110
87

$$37{\cdot}24 \div 2{\cdot}9 = \frac{3724}{100} \times \frac{10}{29} = \frac{3724000}{29} \times \frac{1}{10000} = \frac{128413\ldots\ldots}{10000} = 12{\cdot}8413\ldots\ldots$$

27·53) ·071900 (·0026
5506
16840
16518

$$\cdot0719 \div 27{\cdot}53 = \frac{719}{10000} \times \frac{100}{2753} = \frac{26\ldots\ldots}{10000} = \cdot0026\ldots\ldots$$

3. (1) 157) ·0029202 (·0000186
157
1350
1256
942
942

$$\cdot0029202 \div 157 = \frac{29202}{10000000} \times \frac{1}{157} = \frac{186}{10000000} = \cdot0000186.$$

1·57) ·0029202 (·00186

$$\cdot0029202 \div 1{\cdot}57 = \frac{29202}{10000000} \times \frac{100}{157} = \frac{186}{100000} = \cdot00186.$$

(2) 1953125) 5005·00000000 (·00256256
3906250
10987500
9765625
12218750
11718750
5000000
3906250
10937500
9765625
11718750
11718750

$$5005 \div 1953125 = \frac{500500000000}{1953125} \times \frac{1}{100000000} = \frac{256256}{100000000} = \cdot00256256.$$

$$195{\cdot}3125\,)\,50{\cdot}05\,(\,{\cdot}256256$$

$$50{\cdot}05 \div 195{\cdot}3125 = \frac{5005}{100} \times \frac{10000}{1953125} = \frac{500500000000}{1953125} \times \frac{1}{1000000}$$

$$= \frac{256256}{1000000} = {\cdot}256256.$$

$${\cdot}0001953125\,)\,{\cdot}05005\,(\,256{\cdot}256$$

$${\cdot}05005 \div {\cdot}0001953125 = \frac{5005}{100000} \times \frac{10000000000}{1953125}$$

$$= \frac{500500000000}{1953125} \times \frac{1}{1000} = \frac{256256}{1000} = 256{\cdot}256.$$

(3) $7\tfrac{1}{2} \text{ of } \frac{1}{5} + \frac{17}{25} = \frac{3}{2} + \frac{17}{25} = \frac{109}{50} = \frac{218}{100} = 2{\cdot}18,$

$${\cdot}0005\,)\,2{\cdot}1800\,(\,4360;$$

$$\frac{428}{515} \text{ of } \frac{5}{4} \text{ of } \frac{5253}{18190} = \frac{107 \times 4 \times 5 \times 51 \times 103}{103 \times 5 \times 4 \times 107 \times 170} = \frac{51}{170} = \frac{3 \times 17}{17 \times 10} = \frac{3}{10} = {\cdot}3,$$

$$\therefore\ 31{\cdot}008 \div {\cdot}3 = 103{\cdot}36;$$

$$16\tfrac{2}{3} = \frac{50}{3} = \frac{100}{6},$$

and $${\cdot}7575 \div \frac{100}{6} = \frac{{\cdot}7575 \times 6}{100} = \frac{4{\cdot}5450}{100} = {\cdot}04545.$$

Ex. XXIX. (p. 75.)

(1) $\begin{array}{r|l} 4 & 1{\cdot}00 \\ \hline & {\cdot}25 \end{array}$ $\qquad \begin{array}{r|l} 4 & 3{\cdot}00 \\ \hline & {\cdot}75 \end{array}$ $\qquad \begin{array}{r|l} 8 & 5{\cdot}000 \\ \hline & {\cdot}625 \end{array}$

$25\begin{cases}5\\5\end{cases}\begin{array}{|r} 9{\cdot}0 \\ \hline 1{\cdot}80 \\ \hline {\cdot}36 \end{array}$ $\qquad 16\begin{cases}8\\2\end{cases}\begin{array}{|r} 2{\cdot}000 \\ \hline {\cdot}6250 \\ \hline {\cdot}3125 \end{array}$ $\qquad 20\begin{cases}10\\2\end{cases}\begin{array}{|r} 19{\cdot}0 \\ \hline 1{\cdot}90 \\ \hline {\cdot}95 \end{array}$

(2) $128\begin{cases}4\\4\\4\\2\end{cases}\begin{array}{|r} 66{\cdot}0 \\ \hline 16{\cdot}5 \\ \hline 4{\cdot}125 \\ \hline 1{\cdot}03125 \\ \hline {\cdot}515625 \end{array}$ $\qquad 125\begin{cases}5\\5\\5\end{cases}\begin{array}{|r} 0.45 \\ \hline 10{\cdot}8 \\ \hline 2{\cdot}16 \\ \hline {\cdot}432 \end{array}$

$$200\left\{\begin{array}{r}100\\2\end{array}\right.\begin{array}{|l}570\\\hline 5{\cdot}7\\\hline 2{\cdot}85\end{array}\qquad 125\left\{\begin{array}{r}5\\5\\5\end{array}\right.\begin{array}{|l}170\\\hline 34\\\hline 6{\cdot}8\\\hline 1{\cdot}36\end{array}\qquad 160\left\{\begin{array}{r}4\\4\\10\end{array}\right.\begin{array}{|l}1{\cdot}0\\\hline {\cdot}25\\\hline {\cdot}0625\\\hline {\cdot}00625\end{array}$$

(3) $$64\left\{\begin{array}{r}4\\4\\4\end{array}\right.\begin{array}{|l}11{\cdot}00\\\hline 2{\cdot}75\\\hline {\cdot}6875\\\hline {\cdot}171875\end{array}\qquad 240\left\{\begin{array}{r}10\\4\\6\end{array}\right.\begin{array}{|l}57\\\hline 5{\cdot}7\\\hline 1{\cdot}425\\\hline {\cdot}2375\end{array}$$

$\therefore$ *Ans.* $= 6{\cdot}171875$.

$$256\left\{\begin{array}{r}4\\4\\4\\4\end{array}\right.\begin{array}{|l}13\\\hline 3{\cdot}25\\\hline {\cdot}8125\\\hline {\cdot}203125\\\hline {\cdot}05078125\end{array}\qquad 512\left\{\begin{array}{r}4\\4\\4\\4\\2\end{array}\right.\begin{array}{|l}3{\cdot}00\\\hline {\cdot}75\\\hline {\cdot}1875\\\hline {\cdot}046875\\\hline {\cdot}01171875\\\hline {\cdot}005859375\end{array}$$

$$\frac{588}{78125}=\frac{117{\cdot}6}{15625}=\frac{23{\cdot}52}{3125}=\frac{4{\cdot}704}{625}=\frac{{\cdot}9408}{125}=\frac{{\cdot}18816}{25}=\frac{{\cdot}037632}{5}={\cdot}0075264;$$

$\therefore$ *Ans.* $= 15{\cdot}0075264$.

2. (1) $3\frac{5}{8}$ of $\frac{1}{512}=\frac{29}{8\times 512}=\frac{3{\cdot}625}{512}=\frac{{\cdot}453125}{64}=\frac{{\cdot}056640625}{8}={\cdot}007080078125.$

(2) $\frac{1}{2}+\frac{1}{4}+\frac{1}{16}+\frac{1}{32}=\frac{16+8+2+1}{32}=\frac{27}{32}=\frac{6{\cdot}75}{8}={\cdot}84375.$

(3) $\frac{1}{64}\times{\cdot}0064=\frac{1}{64}\times\frac{64}{10000}=\frac{1}{10000}={\cdot}0001.$

(4) $\frac{3}{5}+{\cdot}061={\cdot}6+{\cdot}061={\cdot}661.$

(5) $\frac{1}{2}+\frac{1}{5}-\frac{1}{8}=\frac{20+8-5}{40}=\frac{23}{40}=\frac{2{\cdot}3}{4}={\cdot}575.$

(6) $\frac{47\frac{5}{8}}{94}$ of $\frac{11\frac{3}{4}}{7{\cdot}5}=\frac{47{\cdot}625}{94}\times\frac{47}{4\times 7{\cdot}5}=\frac{47{\cdot}625}{2\times 30}=\frac{4{\cdot}7625}{6}={\cdot}79375.$

(7) $\frac{7{\cdot}75}{9}$ of $\frac{2\frac{1}{2}}{2\frac{7}{9}}$ of $\frac{20}{31}=\frac{7{\cdot}75}{9}$ of $\dfrac{\frac{5}{2}}{\frac{25}{9}}$ of $\frac{20}{31}$

$$=\frac{7{\cdot}75\times 5\times 9\times 20}{9\times 2\times 25\times 31}=\frac{7{\cdot}75\times 10}{5\times 31}=\frac{7{\cdot}75\times 2}{31}=\frac{15{\cdot}5}{31}={\cdot}5.$$

(8) $$5\frac{5}{640}+\cdot75\text{ of }\frac{6}{5}\text{ of }7\tfrac{1}{2}=5\frac{\cdot625}{80}+\cdot75\times\frac{6}{5}\times\frac{15}{2}$$

$$=5\frac{\cdot078125}{10}+\cdot75\times9=5\cdot0078125+6\cdot75=11\cdot7578125.$$

(9) $$3\frac{4}{25}+\frac{33}{110}+81\frac{37}{1000}+\frac{7\frac{3}{4}}{3\frac{7}{8}}=3\frac{\cdot8}{5}+\frac{3}{10}+81\frac{37}{1000}+\frac{31\times8}{31\times4}$$

$$=3\cdot16+\cdot3+81\cdot037+2=86\cdot497.$$

(10) $$\frac{\;\frac{247}{5}\;}{7}+\frac{1512}{108}+\frac{17}{7\frac{5}{9}}+200\frac{7}{10}+\frac{11}{62\cdot5}$$

$$=\frac{1729}{5}+\frac{168}{12}+\frac{17\times9}{68}+200\frac{7}{10}+\frac{110}{625}$$

$$=345\cdot8+14+\frac{9}{4}+200\cdot7+\frac{4\cdot4}{25}$$

$$=345\cdot8+14+2\cdot25+200\cdot7+\cdot176=562\cdot926.$$

Ex. XXX. (p. 80.)

1. (1) $$\begin{array}{r|l} 9 & \underline{5\cdot0\qquad} \\ & \cdot\dot{5}5\ldots\ldots \end{array}\qquad \begin{array}{r|l} 11 & \underline{2\cdot00\qquad} \\ & \cdot\dot{1}\dot{8}18\ldots\ldots \end{array}\qquad \begin{array}{r} 37\,)\,1\cdot000\,(\cdot\dot{0}2\dot{7}\ldots\ldots \\ \underline{74}\quad\;\; \\ 260\quad\; \\ \underline{259}\quad\; \\ 1\quad\; \end{array}$$

$$\begin{array}{r|l} 7 & \underline{3\cdot\qquad\qquad} \\ & \cdot\dot{4}28571\dot{4}\ldots\ldots \end{array}$$

(2) $$\frac{17}{30}=\frac{1\cdot7}{3}=\cdot5\dot{6}6\ldots\ldots;\quad \frac{368}{495}=\frac{73\cdot6}{99}=\frac{8\cdot1\dot{7}7\ldots\ldots}{11}=\cdot7\dot{4}\dot{3}43\ldots\ldots;$$

$$\frac{16}{81}=\frac{1\cdot\dot{7}7\ldots\ldots}{9}=\cdot\dot{1}9753086\dot{4};$$

$$\begin{array}{r} 333\,)\,52\cdot000\,(\cdot\dot{1}5\dot{6} \\ \underline{333}\qquad\quad \\ 1870\qquad \\ \underline{1665}\qquad \\ 2050\quad \\ \underline{1998}\quad \\ 52\quad \end{array}$$

$$\therefore\ 15\frac{52}{333}=15\cdot\dot{1}5\dot{6}.$$

(3) $\frac{3231}{3520}=\frac{323\cdot1}{352}=\frac{29\cdot3\dot{7}\dot{2}72\ldots\ldots}{32}=\frac{7\cdot343\dot{1}\dot{8}18\ldots\ldots}{8}=\cdot917897\dot{7}\dot{2}.$

```
3367) 962·000000 (·2̇85714̇
       6734
       28860
       26936
        19240
        16835
         24050
         23569
           4810
           3367
           14430
           13468
             962
```

$\therefore 7\frac{962}{3367}=7\cdot\dot{2}8571\dot{4};$

$\frac{17}{99000}=\frac{\cdot017}{99}=\frac{\cdot001\dot{5}\dot{4}}{9}=\cdot000\dot{1}\dot{7}.$

(4)

```
9768) 83·000000000 (·0084̇97133̇
      78144
      48560
      39072
       94880
       87912
        69680
        68376
         13040
          9768
          32720
          29304
           34160
           29304
            4856
```

$\therefore 24\frac{83}{9768}=24\cdot008\dot{4}9713\dot{3};$

$17\frac{13}{700}=17\frac{\cdot13}{7}=17\cdot01\dot{8}5714\dot{2};$

$2\frac{139868}{833325}=2\frac{27973\cdot6}{166665}=2\frac{5594\cdot72}{33333};$

$$
\begin{array}{r}
33333\,)\,5594\cdot7200000\,(\cdot16\dot{7}843\dot{2}\hphantom{0000000000000000}\\
\underline{33333}\hphantom{000000}\\
226142\hphantom{00000}\\
\underline{199998}\hphantom{00000}\\
261440\hphantom{0000}\\
\underline{233331}\hphantom{0000}\\
281090\hphantom{000}\\
\underline{266664}\hphantom{000}\\
144260\hphantom{00}\\
\underline{133332}\hphantom{00}\\
109280\hphantom{0}\\
\underline{99999}\hphantom{0}\\
92810\\
\underline{66666}\\
26144
\end{array}
$$

$$\therefore 2\frac{139868}{833325}=2\cdot16\dot{7}843\dot{2}.$$

2. (1) $\cdot\dot{7}=\frac{7}{9}$; $\cdot0\dot{7}=\frac{7-0}{90}=\frac{7}{90}$; $\cdot2\dot{2}\dot{7}=\frac{227-2}{990}=\frac{225}{990}=\frac{25}{110}=\frac{5}{22}$.

(2) $\cdot5\dot{8}\dot{3}=\frac{583-5}{990}=\frac{578}{990}=\frac{289}{495}$; $\cdot\dot{1}3\dot{5}=\frac{135}{999}=\frac{45}{333}=\frac{15}{111}=\frac{5}{37}$;

$\cdot26\dot{3}=\frac{263-26}{900}=\frac{237}{900}=\frac{79}{300}$.

(3) $\cdot00\dot{1}8\dot{5}=\frac{185}{99900}=\frac{37}{19980}$; $3\cdot\dot{0}2\dot{4}=3\frac{24}{999}=3\frac{8}{333}=\frac{1007}{333}$;

$\cdot012\dot{3}\dot{6}=\frac{1236-12}{99000}=\frac{1224}{99000}=\frac{153}{12375}=\frac{17}{1375}$.

(4) $\cdot\dot{1}4285\dot{7}=\frac{142857}{999999}=\frac{15873}{111111}=\frac{5291}{37037}=\frac{481}{3367}$;

$\cdot39791\dot{6}=\frac{397916-39791}{900000}=\frac{358125}{900000}=\frac{71625}{180000}$

$=\frac{14325}{36000}=\frac{2865}{7200}=\frac{573}{1440}=\frac{191}{480}$;

$\cdot382\dot{1}4285\dot{7}=\frac{382142857-382}{999999000}=\frac{382142475}{999999000}=\frac{42460275}{111111000}$

$=\frac{3860025}{10101000}=\frac{772005}{2020200}=\frac{154401}{404040}=\frac{51467}{134680}$.

(5) $$\cdot\dot{3}0769\dot{2}=\frac{307692}{999999}=\frac{102564}{333333}=\frac{9324}{30303}=\frac{1036}{3367};$$

$$\cdot 6\dot{3}0769\dot{2}=\frac{6307692-6}{9999990}=\frac{6307686}{9999990}=\frac{2102562}{3333330}$$

$$=\frac{191142}{303030}=\frac{21238}{33670}=\frac{10619}{16835};$$

$$2\cdot 7\dot{8}5714\dot{2}=2\frac{7857142-7}{9999990}=2\frac{7857135}{9999990}=2\frac{2619045}{3333330}=2\frac{238095}{303030}$$

$$=2\frac{79365}{101010}=2\frac{15873}{20202}=2\frac{5291}{6734}=2\frac{481\times 11}{481\times 14}=2\frac{11}{14}=\frac{39}{14}.$$

(6) $$\cdot 342\dot{7}5\dot{3}=\frac{342753-342}{999000}=\frac{342411}{999000}=\frac{114137}{333000};$$

$$\cdot 03132\dot{1}3\dot{2}=\frac{3132132-3132}{99900000}=\frac{3129000}{99900000}=\frac{1043}{33300};$$

$$8\cdot 0208\dot{3}=8\frac{2083-208}{90000}=8\frac{1875}{90000}=8\frac{375}{18000}=8\frac{75}{3600}=8\frac{15}{720}$$

$$=8\frac{1}{48}=\frac{385}{48}.$$

(7) $$85\cdot 6080\dot{6}=85\frac{60806-6080}{90000}=85\frac{54726}{90000}=85\frac{9121}{15000}$$

$$=\frac{1275000+9121}{15000}=\frac{1284121}{15000};$$

$$3\cdot 6\dot{4}2857\dot{1}=3\frac{6428571-6}{9999990}=3\frac{6428565}{9999990}=3\frac{714285}{1111110}$$

$$=3\frac{79365\times 9}{79365\times 14}=3\frac{9}{14}=\frac{51}{14};$$

$$127\cdot 000220\dot{9}\dot{5}=127\frac{22095-220}{99000000}=127\frac{21875}{99000000}$$

$$=127\frac{4375}{19800000}=127\frac{875}{3960000}=127\frac{175}{792000}=127\frac{35}{158400}$$

$$=127\frac{7}{31680}=\frac{4023367}{31680}.$$

Ex. XXXI. (p. 81.)

1. (1)

$$\begin{array}{r}2\cdot418418418\\1\cdot166666667\\3\cdot009009009\\\cdot735444444\\24\cdot042\\\hline 31\cdot371538538\end{array}$$

$\therefore$ *Ans.* $=31\cdot371538$.

(2)

$$\begin{array}{r}234\cdot666\dot{6}666667\\9\cdot9288888889\\\cdot0123456789\\\cdot0044004400\\456\cdot\\\hline 700\cdot61230167456\end{array}$$

$\therefore$ *Ans.* $=700\cdot612301$.

(3)

$$\begin{array}{r}6\cdot45\\\cdot3333333\\\hline 6\cdot1166667\end{array}$$

$\therefore$ *Ans.* $=6\cdot116666$.

$$\begin{array}{r}7\cdot72727272\\6\cdot04545454\\\hline 1\cdot68181818\end{array}$$

$\therefore$ *Ans.* $=1\cdot681818$.

$$\begin{array}{r}309\cdot\\\cdot94724724\\\hline 308\cdot05275276\end{array}$$

$\therefore$ *Ans.* $=308\cdot052752$.

2.

$$\frac{49}{52}+\frac{278}{390}+\frac{7}{12}=\frac{49\times15+278\times2+7\times65}{780}$$

$$=\frac{735+556+475}{780}=\frac{1746}{780}=\frac{174\cdot6}{78}=\frac{29\cdot1}{13}=2\cdot2\dot{3}8461\dot{5};$$

$$18\frac{1}{12}-4\frac{5}{14}=18\cdot083333333-4\cdot357142857=13\cdot72\dot{6}1904\dot{7}6.$$

3. (1)

$$2\cdot\dot{3}\times5\cdot\dot{6}=2\tfrac{1}{3}\times5\tfrac{2}{3}=\frac{7\times17}{9}=\frac{119}{9}=13\cdot\dot{2};$$

$$\cdot75\dot{7}\dot{5}\times\cdot36\dot{6}=\frac{7575-75}{9900}\times\frac{366-36}{900}=\frac{75}{99}\times\frac{330}{900}$$

$$=\frac{75\times33}{99\times90}=\frac{5}{3\times6}=\frac{2\cdot5}{9}=\cdot2\dot{7}.$$

(2)

$$\cdot40\dot{6}\times62=\frac{406-40}{900}\times62=\frac{366\times62}{900}=\frac{122\times62}{300}$$

$$=\frac{7564}{300}=\frac{75\cdot64}{3}=25\cdot21\dot{3};$$

$$825\times\cdot\dot{3}\dot{6}=825\times\frac{36}{99}=\frac{825\times4}{11}=75\times4=300.$$

(3)

$$7\cdot5\dot{2}\times48\cdot\dot{3}=7\tfrac{47}{90}\times48\tfrac{1}{3}=\frac{677\times145}{90\times3}=\frac{98165}{90\times3}$$

$$=\frac{9816\cdot5}{9\times3}=\frac{1090\cdot7\dot{2}}{3}=363\cdot5\dot{7}4\dot{0};$$

$$368\times\cdot\dot{6}=368\times\frac{2}{3}=\frac{736}{3}=245\cdot\dot{3}.$$

(4) $3{\cdot}1\dot{4}\dot{5} \times {\cdot}4\dot{2}9\dot{7} = 3\frac{144}{990} \times \frac{4293}{9990} = \frac{3114 \times 4293}{990 \times 9990} = \frac{13368402}{9890100} = 1{\cdot}35169\ldots.$

$20\frac{4}{7} \times {\cdot}\dot{8}\dot{4} = \frac{144}{7} \times \frac{84}{99} = \frac{16 \times 12}{11} = \frac{192}{11} = 17{\cdot}\dot{4}\dot{5}.$

4. (1) $195{\cdot}0\dot{2} \div 4 = 48{\cdot}7\dot{5}$;

$${\cdot}37\dot{5}9\dot{2} \div {\cdot}0\dot{5} = \frac{37592-37}{99900} \times \frac{90}{5} = \frac{37555 \times 90}{99900 \times 5}$$

$$= \frac{7511}{1110} = \frac{203 \times 37}{30 \times 37} = \frac{20{\cdot}3}{3} = 6{\cdot}7\dot{6}.$$

(2) $54 \div {\cdot}1\dot{7} = 54 \div \frac{16}{90} = \frac{54 \times 90}{16} = \frac{27 \times 90}{8} = \frac{2430}{8} = 303{\cdot}75$;

$13{\cdot}\dot{2} \div 5{\cdot}\dot{6} = 13\frac{2}{9} \div 5\frac{2}{3} = \frac{119}{9} \times \frac{3}{17} = \frac{7}{3} = 2{\cdot}\dot{3}.$

(3) $411{\cdot}3\dot{5}1\dot{9} \div 58{\cdot}7\dot{6}4\dot{5} = 411\frac{3516}{9990} \div 58\frac{7638}{9990}$

$$= \frac{4109406}{9990} \times \frac{9990}{587058} = \frac{4109406}{587058} = 7;$$

$2{\cdot}1659\dot{5} \div {\cdot}0\dot{4} = 2\frac{14936}{90000} \times \frac{90}{4} = \frac{194936}{4 \times 1000} = \frac{48734}{1000} = 48{\cdot}734$;

$${\cdot}6559\dot{9}0\dot{3} \div 48{\cdot}76 = \frac{6553344}{9990000} \times \frac{100}{4876}$$

$$= \frac{1344 \times 4876}{99900 \times 4876} = \frac{13{\cdot}44}{999} = {\cdot}0134\ldots.$$

QUESTIONS AND EXAMPLES IN DECIMALS.

Ex. XXXII. (p. 81.)

I.

(1) ${\cdot}0625 = \frac{625}{10000} = \frac{25}{400} = \frac{1}{16}$; $3{\cdot}14159 = \frac{314159}{100000}$;

$20\frac{5}{14} = 20{\cdot}3\dot{5}71428\dot{5}71$

$$17\frac{1}{12} = \frac{17{\cdot}08\dot{3}3333333}{3{\cdot}27\dot{3}80952\dot{3}8}$$

(2) $$10\tfrac{3}{8} + 1\tfrac{5}{40} + \frac{7}{10} + \frac{13}{16} = 11 + \frac{3}{8} + \frac{1}{8} + \frac{7}{10} + \frac{13}{16}$$

$$= 11 + \frac{30 + 10 + 56 + 65}{80} = 11 + \frac{161}{80} = 13\tfrac{1}{80} = 13{\cdot}0125.$$

Again,

$$10\tfrac{3}{8} + 1\tfrac{5}{40} + \frac{7}{10} + \frac{13}{16} = 10{\cdot}375 + 1{\cdot}125 + {\cdot}7 + {\cdot}8125 = 13{\cdot}1025.$$

(3)
$$\begin{array}{r} 573{\cdot}005 \\ {\cdot}000754 \\ \hline 573{\cdot}005754 \end{array} \qquad \begin{array}{r} 573{\cdot}005 \\ {\cdot}000754 \\ \hline 573{\cdot}004246 \end{array} \qquad \begin{array}{r} 573{\cdot}005 \\ {\cdot}000754 \\ \hline 2292020 \\ 2865025 \\ 4011035 \\ \hline {\cdot}432045770 \end{array}$$

$$\begin{array}{l} {\cdot}000754)\ 573{\cdot}0050000\ (759953{\cdot}5\ldots. \\ \begin{array}{r} \underline{5278} \\ 4520 \\ \underline{3770} \\ 7505 \\ \underline{6786} \\ 7190 \\ \underline{6786} \\ 4040 \\ \underline{3770} \\ 2700 \\ \underline{2262} \\ 4380 \\ \underline{3770} \\ 610 \end{array} \end{array}$$

Proofs of the above:

$$573{\cdot}005 + {\cdot}000754 = \frac{573005}{1000} + \frac{754}{1000000} = \frac{573005000 + 754}{1000000}$$

$$= \frac{573005754}{1000000} = 573{\cdot}005754;$$

$$573{\cdot}005 - {\cdot}000754 = \frac{573005000 - 754}{1000000} = \frac{573004246}{1000000} = 573{\cdot}004246;$$

$$573{\cdot}005 \times {\cdot}000754 = \frac{573005}{1000} \times \frac{754}{1000000} = \frac{432045770}{1000000000} = {\cdot}43204577;$$

$$573{\cdot}005 \div {\cdot}000754 = \frac{573005}{1000} \times \frac{1000000}{754}$$

$$= \frac{5730050000}{754} \times \frac{1}{10} = 759953{\cdot}5\ldots.$$

Again,

$$\begin{array}{r} 1{\cdot}015 \\ {\cdot}01015 \\ \hline 1{\cdot}02515 \end{array} \qquad \begin{array}{r} 1{\cdot}015 \\ {\cdot}01015 \\ \hline 1{\cdot}00485 \end{array} \qquad \begin{array}{r} 1{\cdot}015 \\ {\cdot}01015 \\ \hline 5075 \\ 1015 \\ 1015 \\ \hline {\cdot}01030225 \end{array}$$

$$\begin{array}{l} {\cdot}01015)\,1{\cdot}01500\,(100 \\ \qquad\quad\;\; \underline{1015} \\ \qquad\qquad\;\; 00 \end{array}$$

Proofs of the above:

$$1{\cdot}015+{\cdot}01015=\frac{1015}{1000}+\frac{1015}{100000}=\frac{101500+1015}{100000}=\frac{102515}{100000}=1{\cdot}02515;$$

$$1{\cdot}015-{\cdot}01015=\frac{101500-1015}{100000}=\frac{100485}{100000}=1{\cdot}00485;$$

$$1{\cdot}015\times{\cdot}01015=\frac{1015}{1000}\times\frac{1015}{100000}=\frac{1030225}{100000000}={\cdot}01030225;$$

$$1{\cdot}015\div{\cdot}01015=\frac{1015}{1000}\times\frac{100000}{1015}=\frac{100000}{1000}=100.$$

(4) $$\frac{3}{6144}=\frac{1}{2048}=\frac{1}{8\times256}=\frac{1}{8\times8\times32}=\frac{1}{2^3\times2^3\times2^5},$$

and therefore, since each factor of the denominator is a power of 2, the fraction is convertible into a terminating decimal.

(5) 1. $$2\tfrac{1}{3}+72\tfrac{5}{8}+316\tfrac{1}{6}+2{\cdot}875=390+\frac{1}{3}+\frac{5}{8}+\frac{1}{6}+2{\cdot}875=390+\frac{27}{24}+2{\cdot}875$$

$$=391+\frac{1}{8}+2{\cdot}875=391+{\cdot}125+2{\cdot}875=394.$$

2. $${\cdot}026649\div2\tfrac{15}{16}={\cdot}026649\times\frac{16}{47}={\cdot}00567\times16={\cdot}009072.$$

3. $$\frac{1-{\cdot}05}{5+{\cdot}5}\times\frac{3-{\cdot}8}{3{\cdot}8}\div\frac{1}{10}=\frac{{\cdot}95}{5{\cdot}5}\times\frac{2{\cdot}2}{3{\cdot}8}\times\frac{10}{1}$$

$$=\frac{19\times{\cdot}05}{11\times{\cdot}5}\times\frac{11\times{\cdot}2}{19\times{\cdot}2}\times\frac{10}{1}=\frac{{\cdot}05\times10}{{\cdot}5}=\frac{{\cdot}5}{{\cdot}5}=1.$$

4. $$\{{\cdot}18+{\cdot}009\}\div{\cdot}016={\cdot}189\div{\cdot}016=\frac{189}{1000}\times\frac{1000}{16}=\frac{189}{16}$$

$$=\frac{47{\cdot}25}{4}=11{\cdot}8125.$$

(6) $$\frac{48\frac{4}{7}}{1085\frac{7}{10}}\div\frac{7\frac{3}{11}}{174\frac{3}{17}}=\frac{\frac{340}{7}}{\frac{10857}{10}}\div\frac{\frac{80}{11}}{\frac{2961}{17}}=\frac{340\times10}{7\times10857}\div\frac{80\times17}{11\times2961}$$

$$=\frac{340\times10\times11\times2961}{7\times10857\times80\times17}=\frac{17\times4\times5\times10\times11\times141\times3\times7}{7\times141\times77\times2\times4\times10\times17}$$

$$=\frac{5\times3}{7\times2}=\frac{15}{7\times2}=\frac{7\cdot5}{7}=1\cdot0\dot{7}1428\dot{5};$$

$$91\cdot\dot{8}5\dot{3}\div87\cdot5\dot{6}=91\frac{853}{999}\div87\frac{51}{90}=\frac{91762}{999}\times\frac{90}{7881}=\frac{917620}{111\times7881}$$

$$=\frac{97620}{874791}=1\cdot048\ldots\ldots=1\cdot05\text{ nearly.}$$

II.

(1) $\cdot000000700409$; $\frac{121345}{10000}=\frac{24269}{2000}$; $\cdot0032546$.

(2) Three hundred and ninety-seven thousand and eight, and four hundred and five thousand and nine millionths; $397008405\cdot009$; $397\cdot008405009$. Three hundred and ninety-seven millions, eight thousand four hundred and five, and nine thousandths. Three hundred and ninety-seven, and eight millions four hundred and five thousand and nine thousand millionths.

(3) $$\frac{5}{8}=\cdot625$$

$$\frac{7}{16}=\cdot4375$$

$$\frac{3}{4}=\cdot75$$

$$\begin{array}{rr|r} & & \cdot09375 \\ & & 2\cdot46 \\ \cline{3-3} & 5 & 4\cdot36625 \\ \cline{3-3} 125 & 5 & \cdot87325 \\ \cline{3-3} & 5 & \cdot17465 \\ \cline{3-3} & & \cdot03493 \end{array}$$

decimal required $\cdot03493$

(4) $$\begin{array}{r} 1\cdot05 \\ 10\cdot5 \\ \hline 525 \\ 105 \\ \hline 11\cdot025 \end{array}$$

$$=\frac{11025}{1000}=\frac{2205}{200}=\frac{441}{40},$$

$$\begin{array}{rr|r} & 9 & \cdot8727588 \\ \cline{3-3} & 9 & \cdot0969732 \\ \cline{3-3} 1620 & 2 & \cdot0107748 \\ \cline{3-3} & 10 & \cdot0053874 \\ \cline{3-3} & & \cdot00053874 \end{array}$$

$$\frac{\cdot0003\times\cdot004}{\cdot006}=\frac{\cdot0000012}{\cdot006}=\cdot0002;$$

$$\frac{1}{16}+\frac{9}{400}-\frac{13}{625}=\frac{625+225-208}{10000}=\frac{642}{10000}=\cdot0642.$$

(5) 1.

23) 21·0 (·91304....
207
30
23
70
69
100
92

$$\therefore \frac{1}{10000} \text{ of } \frac{21}{23} = \cdot000091304\ldots.$$

2. $$(2\tfrac{1}{2}+6)\div\left(3\tfrac{1}{2}-\frac{1}{8}\right)=\frac{17}{2}\div\frac{27}{8}=\frac{17\times 8}{2\times 27}=\frac{68}{27}=\frac{22\cdot\dot{6}}{9}=2\cdot\dot{5}1\dot{8}.$$

3. $$\frac{4\cdot4+\frac{3}{5}}{7\cdot375+\frac{3}{4}-\frac{1}{8}}=\frac{4\cdot4+\cdot6}{7\cdot375+\cdot75-\cdot125}=\frac{5}{8\cdot125-\cdot125}=\frac{5}{8}=\cdot625.$$

4. $$2\frac{1}{3000}=2\frac{\cdot001}{3}=2\cdot000\dot{3}33$$

$$1\frac{5}{1600}=1\frac{\cdot05}{16}=1\cdot003125$$

$$5\frac{1}{6000}=5\frac{\cdot001}{6}=5\cdot0001\dot{6}7$$

2·000875
10·0045

(6)

3132·458) 7823·6572 (2·4976096088
6264916
15587412
12529832
30575800
28192122
23836780
21927206
19095740
18794748
30099200
28192122
19070780
18794748
27603200
25059664
25435360
25059664
375696

III.

1) 1200·21) 684·1197 (·57
600105
840147
840147

·0120021) 684·1197000 (57000

·047) 594·270000 (12644·042....
47
124
94
302
282
207
188
190
188
200
188
120
94
26

2) 1. $\frac{\cdot015\times2\cdot1}{\cdot035}=\frac{\frac{15}{1000}\times\frac{21}{10}}{\frac{35}{1000}}=\frac{15\times21\times1000}{1000\times10\times35}=\frac{3\times3}{10}=\frac{9}{10}=\cdot9.$

2. $\frac{3\frac{1}{2}-\cdot04}{5-\cdot0625}=\frac{\frac{7}{2}-\frac{4}{100}}{5-\frac{625}{10000}}=\frac{\frac{350-4}{100}}{\frac{50000-625}{10000}}=\frac{34600}{49375}$

$=\frac{6920}{9875}=\frac{1384}{1975}=\cdot7007\ldots.$

3. $\frac{3}{5}+\cdot14+\frac{3}{4}$ of $1\cdot0784=\frac{3}{5}+\frac{14}{100}+\frac{3}{4}$ of $\frac{10784}{10000}$

$=\frac{74}{100}+\frac{3\times2696}{10000}=\frac{7400+8088}{10000}=\frac{15488}{10000}=1\cdot5488,$

and $\frac{15488}{10000}=\frac{1936}{1250}=\frac{968}{625}.$

4. $\left(\frac{1}{4}-\frac{1}{9}\right)\times\left(\frac{3}{5}+1\frac{1}{2}\right)=\frac{5}{36}\times\frac{21}{10}=\frac{7}{24}=\frac{3\cdot5}{12}=\cdot291\dot{6}.$

(3) $$5\cdot\dot{8}\dot{1}\times\cdot458\dot{3}=5\tfrac{81}{99}\times\frac{4583-458}{9000}=\frac{576\times4125}{99\times9000}=\frac{576\times375}{9\times9000}$$

$$=\frac{64\times375}{9000}=\frac{24000}{9000}=\frac{8}{3}=2\cdot\dot{6};$$

$$1\cdot1\dot{3}\div\cdot00\dot{0}13\dot{2}=1\tfrac{12}{90}\div\frac{132}{999900}=\frac{102}{90}\times\frac{999900}{132}=\frac{102\times9090}{9\times12}$$

$$=\frac{102\times1010}{12}=17\times505=8585,$$

$\frac{91}{560}=\frac{13}{80}$, and since $80=2\times2\times2\times10$, the fraction will be reducibl
to a terminating decimal.

(4) $$1\tfrac{1}{12}+2\tfrac{2}{15}+3\tfrac{3}{20}+4\tfrac{4}{27}=10+\frac{22}{60}+\frac{4}{27}=10+\frac{11}{30}+\frac{4}{27}=10\tfrac{139}{270}.$$

Again, $1\tfrac{1}{12}=1\cdot083\dot{3}33$

$$\begin{array}{r}2\tfrac{2}{15}=2\cdot133\dot{3}33\\ 3\tfrac{3}{20}=3\cdot15\\ 4\tfrac{4}{27}=4\cdot\dot{1}4\dot{8}148\\ \hline 10\cdot5\dot{1}4\dot{8}14\end{array}=10\frac{5143}{9990}=10\,\frac{37\times139}{37\times270}=10\,\frac{139}{270}.$$

(5) He walks $(60-13\cdot95)$ miles $=46\cdot05$ miles in three days,

$$3\,\underline{|\,46\cdot05}$$

he walks $15\cdot35$ miles each day.

(6) He sells $\cdot1\dot{7}$ of $\cdot1875$ or $\frac{16}{90}$ of $\cdot1875$;

therefore, he has left $\left(1-\frac{16}{90}\right)$ of 1875

$$=\frac{74}{90}\text{ of }\cdot1875=\frac{74\times1875}{90\times10000}=\frac{74\times125}{6\times10000}=\frac{74}{6\times80}=\frac{37}{240}.$$

IV.

(1) $$\begin{array}{r}1\cdot23\\ \cdot123\\ \cdot0123\\ \cdot00123\\ 123\cdot\\ \hline 124\cdot36653\end{array}$$

$$=\frac{12436653}{100000}$$

$$31\cdot\dot{4}5\dot{7}=31\,\frac{457}{999},$$

and $$\frac{494}{15}-31\,\frac{457}{999}=32\,\frac{14}{15}-31\,\frac{457}{999}$$

$$=1\,\frac{4662-2285}{4995}=1\,\frac{2377}{4995}.$$

(2) 3006005; three hundred thousand, six hundred and five-tenths.

(3) $5\times{\cdot}05={\cdot}25$; $1{\cdot}5\times{\cdot}75=1{\cdot}125$; $2{\cdot}625\div5={\cdot}525$;

therefore, in order of magnitude they stand thus:

$$1{\cdot}5\times{\cdot}75;\quad 2{\cdot}625\div5;\quad 5\times{\cdot}05.$$

(4) $${\cdot}0\dot{1}4\dot{7}\times{\cdot}33\dot{3}=\frac{147}{9990}\times\frac{1}{3}=\frac{49}{9990}={\cdot}0\dot{0}4\dot{9};$$

$${\cdot}1269\dot{3}\div19{\cdot}\dot{3}\dot{9}=\frac{11424}{90000}\div19\tfrac{39}{99}=\frac{3808}{30000}\div19\tfrac{13}{33}=\frac{3808\times33}{30000\times640}$$

$$=\frac{476\times11}{10000\times80}=\frac{5236}{800000}={\cdot}006545;$$

```
·245) 132790·000 (542000
      1225
      ────
       1029
        980
       ────
         490
         490
        ─────
          000
```

$${\cdot}014904\div3\tfrac{6}{25}=\frac{{\cdot}014904\times25}{81}=\frac{{\cdot}001656\times25}{9}={\cdot}000184\times25={\cdot}0046;$$

```
3·05) 61061·00 (20020              305000) 6106·10000 (·02002
      610                                  610000
      ────                                 ──────
        610                                  610000
        610                                  610000
        ───                                  ──────
          0
```

(5)

```
·90438                                ·90437532
·90437532                             ·90437
─────────                             ─────────
·00000468                             ·00000532
```

and since of these differences ·00000468 is the less, it follows that the statement in the question is correct.

To find an approximate value of the expression

$$16\times\left\{\frac{1}{5}-\frac{1}{3\times5^3}+\frac{1}{5\times5^5}-\frac{1}{7\times5^7}+\text{\&c.}\right\}-\frac{4}{239},$$

we have $\frac{1}{5}={\cdot}2$; $\frac{1}{3\times5^3}=\frac{{\cdot}2}{3\times25}=\frac{{\cdot}008}{3}={\cdot}002667$;

$$\frac{1}{5\times5^5}=\frac{{\cdot}008}{5\times25}=\frac{{\cdot}00032}{5}={\cdot}000064;\ \frac{1}{7\times5^7}=\frac{{\cdot}000064}{7\times5}={\cdot}000002\text{ nearly};$$

the last result shews us that we may neglect the rest of the series, and we get

$$16 \times \{{\cdot}2 - {\cdot}002667 + {\cdot}000064 - {\cdot}000002\} - \frac{4}{239}$$

$$= (16 \times {\cdot}197395) - {\cdot}01673 = 3{\cdot}15832 - {\cdot}01673 = 3{\cdot}14159.$$

(6) After the first sale he has remaining

$${\cdot}85 \text{ or } \frac{17}{20} \text{ of the estate;}$$

therefore, after the second sale he has

$$\left(1 - \frac{5}{17}\right) \text{ of } \frac{17}{20} = \frac{12}{17} \text{ of } \frac{17}{20} = \frac{12}{20} = \frac{3}{5}.$$

V.

(1) $$\frac{1}{2}\left(6\tfrac{1}{2} + 2\tfrac{2}{3} - 3\right) = \frac{1}{2}\left\{5\tfrac{7}{6}\right\} = \frac{1}{2} \times \frac{37}{6} = \frac{37}{12} = 3{\cdot}08\dot{3};$$

$$\frac{8978}{3125} = \frac{1795{\cdot}6}{625} = \frac{359{\cdot}12}{125} = \frac{71{\cdot}824}{25} = \frac{14{\cdot}3648}{5} = 2{\cdot}87296;$$

$$3\tfrac{5}{8} \times \left(3\tfrac{1}{4} - \frac{2}{3}\right) \text{ of } \frac{6}{7} = \frac{29}{8} \times \frac{39-8}{12} \times \frac{6}{7}$$

$$= \frac{29 \times 31 \times 6}{8 \times 12 \times 7} = \frac{899}{8 \times 2 \times 7} = \frac{112{\cdot}375}{2 \times 7} = \frac{56{\cdot}1875}{7} = 8{\cdot}0267\dot{8}5714\dot{2}.$$

(2) 1. $$\frac{4{\cdot}255 \times {\cdot}032}{{\cdot}00016} = \frac{4{\cdot}255 \times {\cdot}016 \times 2}{{\cdot}016 \times {\cdot}01} = \frac{4{\cdot}255 \times 2}{{\cdot}01} = \frac{8{\cdot}51}{{\cdot}01} = 851.$$

2. $$\left(\frac{1}{2} + \frac{1}{4} + \frac{1}{6} + \frac{1}{8} + \frac{1}{10}\right) \div \left(\frac{1}{3} + \frac{1}{5} + \frac{1}{9} + \frac{1}{15}\right)$$

$$= \frac{60 + 30 + 20 + 15 + 12}{120} \div \frac{30 + 18 + 10 + 6}{90} = \frac{137}{120} \times \frac{90}{64}$$

$$= \frac{137 \times 3}{4 \times 64} = \frac{411}{4 \times 64} = \frac{102{\cdot}75}{64} = \frac{12{\cdot}84375}{8} = 1{\cdot}60546875.$$

3. $$\left(\frac{9}{11} \text{ of } 35\tfrac{1}{5} - 3\tfrac{1}{8}\right) + \left(2{\cdot}5625 + 7\tfrac{1}{4}\right)$$

$$= \left(\frac{9}{11} \text{ of } 35{\cdot}2 - 3{\cdot}125\right) + (2{\cdot}5625 + 7{\cdot}25) = 9 \times 3{\cdot}2 - 3{\cdot}125 + 9{\cdot}8125$$

$$= 28{\cdot}8 - 3{\cdot}125 + 9{\cdot}8125 = 25{\cdot}675 + 9{\cdot}8125 = 35{\cdot}4875.$$

4. $$\cdot 59\dot{3} \div 1\cdot 78 \times \cdot\dot{3}\dot{6} \div \cdot 072 = \frac{534}{900} \times \frac{100}{178} \times \frac{36}{99} \times \frac{1000}{72} = \frac{3 \times 1000}{9 \times 99 \times 2}$$

$$= \frac{500}{3 \times 99} = \frac{45\cdot\dot{4}\dot{5}}{3 \times 9} = \frac{5\cdot\dot{0}\dot{5}}{3} = 1\cdot\dot{6}8350\dot{1}.$$

)

$$1 = 1\cdot 00000000$$

$$\frac{1}{1} = 1\cdot 00000000$$

$$\frac{1}{1 \times 2} = \cdot 50000000$$

$$\frac{1}{1 \times 2 \times 3} = \cdot 16666667$$

$$\frac{1}{1 \times 2 \times 3 \times 4} = \cdot 04166667$$

$$\frac{1}{1 \times 2 \times 3 \times 4 \times 5} = \cdot 00833333$$

$$\frac{1}{1 \times 2 \times 3 \times 4 \times 5 \times 6} = \cdot 00138889$$

$$\frac{1}{1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7} = \cdot 00019841$$

$$\frac{1}{1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8} = \cdot 00002480$$

$$\frac{1}{1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9} = \cdot 00000275$$

$$\frac{1}{1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10} = \cdot 00000027$$

$$\frac{1}{1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11} = \cdot 00000002$$

$$\therefore \text{sum} = 2\cdot 71828181$$

$$\frac{1}{10^3} \times \left(1 - \frac{3}{10^2} + \frac{3 \times 4}{1 \times 2} \times \frac{1}{10^4} + \frac{3 \times 4 \times 5}{1 \times 2 \times 3} \times \frac{1}{10^6}\right)$$

$$= \frac{1}{10^3} \times \left(1 - \frac{3}{100} + \frac{6}{10000} + \frac{10}{1000000}\right)$$

$$= \frac{1}{10^3} \times \left(\frac{100000 - 3000 + 60 + 1}{100000}\right)$$

$$= \frac{97061}{1000 \times 100000} = \frac{97061}{100000000} = \cdot 00097061.$$

(5)

$$\begin{array}{r@{}l}
111{\cdot}454\,)\ 883345{\cdot}0000\ (7925{\cdot}7 & \text{ miles nearly} \\
\underline{780178}\phantom{{\cdot}0000\ (7925{\cdot}7} & \\
1031670\phantom{000\ (7925{\cdot}7} & \\
\underline{1003086}\phantom{000\ (7925{\cdot}7} & \\
285840\phantom{00\ (7925{\cdot}7} & \\
\underline{222908}\phantom{00\ (7925{\cdot}7} & \\
629320\phantom{0\ (7925{\cdot}7} & \\
\underline{557270}\phantom{0\ (7925{\cdot}7} & \\
720500\phantom{\ (7925{\cdot}7} &
\end{array}$$

(6)

$$\begin{array}{r}
{\cdot}12\dot{5}55556 \\
4{\cdot}16363636 \\
\underline{9.45777778} \\
13{\cdot}74696970
\end{array}$$

VI.

(1)

$$\begin{array}{r}
404{\cdot}04 \\
\underline{{\cdot}030303} \\
121212 \\
121212 \\
\underline{121212} \\
12{\cdot}24362412
\end{array}$$

$$\cdot\dot{3}4\dot{5}\times\frac{\cdot111}{4\cdot3}=\frac{345}{999}\times\frac{111}{1000}\times\frac{10}{43}$$

$$=\frac{345}{9\times100\times43}=\frac{115}{3\times100\times43}$$

$$=\frac{1\cdot15}{129}=\cdot0089147\ldots.$$

$$\begin{array}{r}
{\cdot}6593\,)\ {\cdot}04813489963\ ({\cdot}0730091 \\
\underline{46151}\phantom{489963\ ({\cdot}0730091} \\
19838\phantom{9963\ ({\cdot}0730091} \\
\underline{19779}\phantom{9963\ ({\cdot}0730091} \\
59996\phantom{63\ ({\cdot}0730091} \\
\underline{59337}\phantom{63\ ({\cdot}0730091} \\
6593\phantom{\ ({\cdot}0730091} \\
\underline{6593}\phantom{\ ({\cdot}0730091}
\end{array}$$

$$\cdot006593\,)\ \cdot04813489963\ (7\cdot30091$$

(2)

$$\begin{array}{r}
20{\cdot}5 \\
\underline{2{\cdot}05} \\
22{\cdot}55
\end{array}
\qquad
\begin{array}{r}
20{\cdot}5 \\
\underline{2{\cdot}05} \\
18{\cdot}45
\end{array}
\qquad
\therefore\ \frac{22\cdot55}{18\cdot45}=\frac{2255}{1845}=\frac{451}{369}.$$

(3)

$$\frac{123\cdot48}{1033\cdot2}=\frac{12348}{103320}=\frac{1029}{8610}=\frac{\cdot343}{2870}=\frac{49}{410};$$

$$\frac{36\cdot595}{5\cdot7980}=\frac{36595}{5798}=\frac{13\times2815}{13\times446}=\frac{2815}{446}=6\tfrac{139}{446}.$$

(4)

$$\frac{\cdot375\times\cdot375-\cdot025\times\cdot025}{\cdot375-\cdot025}=\frac{\cdot140625-\cdot000625}{\cdot375-\cdot025}=\frac{\cdot14}{\cdot35}=\frac{14}{35}=\frac{2}{5};$$

$$3+\cfrac{1}{7+\cfrac{1}{16}}=3+\cfrac{1}{\cfrac{113}{16}}=3\tfrac{16}{113},$$

and $$\begin{array}{r l} 113\overline{)\,16\cdot00} & (\cdot14159\ldots. \\ \underline{113} & \\ 470 & \\ \underline{452} & \\ 180 & \\ \underline{113} & \\ 670 & \\ \underline{565} & \\ 1050 & \\ \underline{1017} & \\ 33 & \end{array}$$

$\therefore\ 3\tfrac{16}{113} = 3\cdot14159$ nearly;

$$\cdot12931\dot{3}\dot{1} = \frac{12931-129}{99000} = \frac{12802}{99000} = \frac{6401}{49500}.$$

(5) $1\tfrac{7}{24} + \frac{5}{8} + \frac{13}{36} = 1 + \frac{21+45+26}{72} = 1\tfrac{92}{72} = 2\tfrac{20}{72};$

therefore, to make this equal to 3, we must add

$$\frac{52}{72} = \frac{13}{18} = \frac{6\cdot5}{9} = \cdot7\dot{2}.$$

(6) Dividend $= 2\tfrac{11}{12} \times \cdot15 = \frac{35\times\cdot15}{12} = \frac{35\times\cdot05}{4} = \frac{17\cdot5}{4} = \cdot4375.$

REDUCTION.

Ex. XXXIII. (p. 102.)

(1) 1.

$$\begin{array}{r} £ \\ 57 \\ \underline{20} \\ 1140s. \\ \underline{12} \\ 13680d. \end{array} \qquad \begin{array}{r} \text{Guineas.} \\ 613 \\ \underline{21} \\ 613 \\ \underline{1226} \\ 12873s. \\ \underline{12} \\ 154476d. \\ \underline{4} \\ 617904q. \end{array}$$

2.

$$\begin{array}{r} £\quad s. \\ 15\ .\ 12 \\ \underline{20} \\ 312s. \\ \underline{12} \\ 3744d. \end{array} \qquad \begin{array}{r} \text{Guineas.} \\ 5000 \\ \underline{21} \\ 105000 \\ \underline{12} \\ 1260000d. \end{array}$$

3. *s.* *d.*
8 . $4\frac{1}{2}$
12
100*d.*
2
201 halfpence.

£ *s.* *d.*
1 . 0 . $3\frac{3}{4}$
20
20*s.*
12
243*d.*
4
975*q.*

4. £ *s.* *d.*
83 . 15 . $6\frac{1}{4}$
20
1675*s.*
12
20106*d.*
4
80425*q.*

£ *s.* *d.*
393 . 0 . $11\frac{1}{2}$
20
7860*s.*
12
94331*d.*
2
188663 halfpence.

Half-crowns.
5. 738
30
22140*d.*
4
88560*q.*

Crowns.
570
5
2850*s.*
3
8550 fourpenny-pieces.

Half-guineas.
6. 2673
21
2673
5346
56133 sixpences.
6
336798*d.*
4
1347192*q.*

Guineas.
$22\frac{1}{2}$
2
45 half-guineas.
21
45
90
945 sixpences.

(2) *q.*
4 | 5673542 — 2*q.*
12 | 1418385 — 9*d.*
2,0 | 11819,8 — 18*s.*
5909

Ans. £5909. 18*s.* $9\frac{1}{2}$*d.*

£ *s.* *d.*
5909 . 18 . $9\frac{1}{2}$
20
118198
12
1418385
4
5673542*q.*

(3) £
25
8
200 half-crowns
5
1000 sixpences.
6
4 | 6000*d.*
1500 fourpences.

(4) Fourpences.
6300
4
3,0 | 2520,0*d.*
840 half-crowns.
5
21 | 4200 sixpences.
200 half-guineas.

(5)

$$\overset{\text{seven-shilling-pieces.}}{351}=\frac{351\times7\times2}{21}=117\times2=\overset{\text{half-guineas.}}{234.}$$

Again,

$$\overset{\text{seven-shilling-pieces.}}{351}=\frac{351\times7}{27}=13\times7=\overset{\text{moidores.}}{91.}$$

(6) 1.

lbs. oz. dwts. grs.
59 . 7 . 14 . 19
12
715
20
14314
24
57256
28628
19
343555 grs.

$$\begin{array}{r|l}
 & \text{grs.} \\
24\begin{cases}4\\6\end{cases} & \begin{array}{l}37400157-1\\ \hline 9350039-5\end{array}\Big\}\ 21 \\
2{,}0 & \underline{155833{,}9}-19\text{ dwts.} \\
12 & \underline{77916} \\
 & 6493
\end{array}$$

lbs. dwts. grs.
Ans. 6493 . 19 . 21

2.

scruples.
56332005
20

$$\begin{array}{r|l}
24\begin{cases}4\\6\end{cases} & \begin{array}{l}1126640100-0\\ \hline 281660025-3\end{array}\Big\}\ 12\text{ grs.} \\
2{,}0 & \underline{46943333{,}7}-17\text{ dwts.} \\
12 & \underline{2347166}\quad-2\text{ oz.} \\
 & 195597
\end{array}$$

lbs. Troy. oz. dwts. grs.
Ans. 195597 . 2 . 17 . 12

lbs.
536
12
6432 oz.
8
51456 drams.
3
154368 scruples.

3.

tons. cwt. qrs. lbs.
7 . 15 . 2 . 16
20
155 cwt.
4
622 qrs.
28
4992
1244
17432 lbs.
16
104592
17432
278912 oz.

$$\begin{array}{r|l}
 & \text{drs.} \\
16\begin{cases}4\\4\end{cases} & \begin{array}{l}7563241-1\\ \hline 1890810-2\end{array}\Big\}\ 9\text{ drs.} \\
16\begin{cases}4\\4\end{cases} & \begin{array}{l}472702-2\\ \hline 118175-3\end{array}\Big\}\ 14\text{ oz.} \\
28\begin{cases}4\\7\end{cases} & \begin{array}{l}29543-3\\ \hline 7385-0\end{array}\Big\}\ 3\text{ lbs.} \\
4 & \underline{1055}-3\text{ qrs.} \\
2{,}0 & \underline{26{,}3}-3\text{ cwt.} \\
 & 13
\end{array}$$

tons. cwt. qrs. lbs. oz. drs.
Ans. 13 . 3 . 3 . 3 . 14 . 9

4\.

oz.

16 {4 | 5838297—1 } 9 oz.
{4 | 1459574—2 }

28 {4 | 364893—1 } 25 lbs.
{7 | 91223—6 }

4 | 13031—3 qrs.

2,0 | 325,7—17 cwt.

162

tons. cwt. qrs. lbs. oz.

Ans. 162 . 17 . 3 . 25 . 9

tons. cwt. qrs. lbs. drs.

33 . 17 . 3 . 27 . 15

20

677 cwt.

4

2711 qrs.

28

21715

5422

75935 lbs.

16

455610

75935

1214960 oz.

16

7289775

1214960

19439375 drs.

5\.

lbs. oz. sc.

17 . 2 . 2

12

206 oz.

8

1648 drs.

3

4946 sc.

20

98920 grs.

grs. Apoth. grs. Troy.

34678 = 34678

the grain being the same in each measure.

24 {4 | 34678—2 } 22 grs.
{6 | 8669—5 }

2,0 | 144,4—4 dwts.

72

oz. dwts. grs.

Ans. 72 . 4 . 22

6\.

cwt. qrs. lbs.

375 . 2 . 15

4

1502 qrs.

28

12031

3004

14 {2 | 42071—1 } 1 lb.
{7 | 21035—0 }

3005

stones. lb.

Ans. 3005 . 1

st.

2 | 573421—1 stone.

4 | 286710—2 qrs.

2,0 | 7167,7—17 cwt.

3583

tons. cwt. qrs. stone.

Ans. 3583 . 17 . 2 . 1

mi. fur. po.
7. 3 . 7 . 8
8
31 fur.
40
1248 poles.
5½
6240
624
6864 yds.

miles.
573
1760
34380
4011
573
1008480 yds.
3
3025440 ft.
12
36305280 inches.

inches.
8. 12 | 1364428—4 in.
3 | 113702—2 ft.
37900
2
11 | 75800—10 half-yards.
4,0 | 689,0—10 po.
8 | 172 —4 fur.
3 | 21
7

lea. fur. po. yds. ft. in.
Ans. 7 . 4 . 10 . 5 . 2 . 4

mi. fur. yds.
74 . 3 . 4
8
595 fur.
40
23800 poles.
5½
119004
11900
130904 yds.
3
392712 ft.
12
4712544 in.

lea. mi. in.
9. 4 . 2 . 2
3
14 mi.
1760
840
98
14
24640 yds.
3
73920 ft.
12
887042 in.
3
2661126 barleycorns.

mi. po.
50 . 3
8
400 fur.
40
16003 po.
5½
80015
8001½
88016½ yards.

fur. yds.
10. 7 . 200
220
22 { 2 | 1740—0 } 2 yds.
11 | 870—1
79

chains. yds.
Ans. 79 . 2

cub. span. cub. in.
6 . 1 = 6 . 9
18
12 | 117—9 in.
9

ft. in.
Ans. 9 . 9

11.
yds. qr.
84 . 1
4
337 qrs.
4
1348 na.

Eng. ells. qr.
56 . 1
5
281 qrs.
4
1124 na.

12.
Fr. ells. qrs.
83 . 3
6
501 qrs.
4
2004 na.

Fl. ells. qr.
73 . 1
3
220 qrs.
4
880 na.

13.
ac. ro.
35 . 2
4
142 ro.
40
5680 po.

ac. ro.
56 . 2
4
226 ro.
40
9040 po.
30¼
271200
2260
273460 sq. yds.

14.
ro. po. yds.
3 . 37 . 26
40
157 po.
30¼
4736
39¼
4775¼ sq. yds.
9
42977¼ sq. ft.
144
171908
171908
42977
36
6188724 sq. inches.

ac. po.
3 . 30
4
12 ro.
40
510 po.
30¼
15300
127½
15427½ sq. yds.
9
138847½ sq. ft.

15.
ac. ro.
15 . 3
4
63 ro.
25000
315000
126
1575000 sq. links.

po.
4,0 | 5000,0
4 | 1250 —2
312

Ans. 312 ac. 2 ro.

16. c. yds.
29
27
203
58
783 c. ft.

1728) 158279 (91 c. ft.
15552
2759
1728
1031

c. ft.
$27\begin{cases}3 \,|\, 91 - 1 \\ 9 \,|\, 30 - 3\end{cases}$ 10 c. ft.
3

Ans. 3 c. yds. 10 c. ft. 1031 c. in.

17. c. yds. c. in.
17 . 1001
27
119
34
459 c. ft.
1728
3672
918
3213
459
1001
794153 c. in.

c. yds. c. ft.
26 . 19
27
201
52
721 c. ft.
1728
5768
1442
5047
721
1245888 c. in.

18. galls.
563
4
2252 qts.
2
4504 pts.

gills.
4 | 365843 — 3 gills.
2 | 91460
4 | 45730 — 2 qts.
11432

Ans. 11432 galls. 2 qts. 3 gills.

19. pipes. hhd. galls.
5 . 1 . 35
2
11
63
33
66
35
728 galls.
8
5824 pts.

gills.
4 | 487634 — 2 gills.
8 | 121908 — 4 pts.
$42\begin{cases}6 \,|\, 15238 - 4 \\ 7 \,|\, 2539 - 5\end{cases}$ 34 galls.
362

Ans. 362 tierces, 34 galls. 4 pts. 2 gills.

20. hhds. bar.
6 . 1
1½
10 bar.
36
360 galls.
8
2880 pts.

pts.
8 | 2307621 — 5 pts.
$63\begin{cases}7 \,|\, 288452 - 3 \\ 9 \,|\, 41207 - 5\end{cases}$ 38 galls.
4578

Ans. 4578 hhds. 38 galls. 5 pts.

21.
bush. pks.
760 . 3
4
3043 pks.
2
6086 galls.
4
24344 qts.

qrs. coomb. pks.
2 . 1 . 3
2
5 coombs.
4
20 bush.
4
83 pks.
2
166 galls.

22.
pints.
8 | 3659712
2 | 457464
4 | 228732
8 | 57183 — 7 bush.
5 | 7147 — 2 qrs.
1429

Ans. 1429 loads, 2 qrs. 7 bush.

lds. qr. bush.
7 . 1 . 2
5
36 qrs.
8
290 bush.
4
1160 pks.

23.
chald.
250
36
1500
750
9000 bush.

pks.
4 | 186043 — 3 pks.
36 { 3 | 46510 — 1 } 34 bush.
36 { 12 | 15503 — 11 } 34 bush.
1291

Ans. 1291 chald. 34 bush. 3 pks.

24.
reams. quires.
56 . 19
20
1139 quires.
24
4556
2278
27336 sheets.

sheets.
24 { 4 | 52073 — 1 } 17 sheets.
24 { 6 | 13018 — 4 } 17 sheets.
2,0 | 2169 quires.
108

Ans. 108 reams, 9 quires, 17 sheets.

25.
wks. dys. hrs.
36 . 5 . 17
7
257 d.
24
1045
514
6185 hrs.
60
371100 min.
60
22266000 sec.

mo. hrs. sec.
1 . 23 . 59
30
30 days.
24
143
60
743 hrs.
60
44580 min.
60
2674859 sec.

(7) half-pints.
2 | 1336381
2 | $668190\frac{1}{2}$ pints.
4 | $334095\frac{1}{4}$ quarts.
36 $\begin{cases} 4 \\ 9 \end{cases}$ | $83523\frac{13}{16}$ gallons.
| $20880\frac{61}{64}$
$2320\frac{61}{576}$ barrels.

(8) dys. hrs.
365 . 6 = $365\frac{1}{4}$ days.
yrs. dys.
27 . 245
$365\frac{1}{4}$
135
162
81
$6\frac{3}{4}$
245
$10106\frac{3}{4}$
24
40424
20212
18
242562 hrs.
60
14553720 min.
60
873223200 sec.

(9)

	dys.	hrs.
In August there remain	26	3
In September there are	30	
In October	31	
In November	30	
In December	31	
In January	31	
In February...............	28	
To March 3rd., 6 A.M...	2	6
	209	9

dys. hrs.
209 . 9
24
845
418
5025 hrs.
60
301500 min.
60
18090000 sec.

(10) sq. miles.
50535 in England.
8125 in Wales.
29167 in Scotland.
87827 sq. miles in all.
640
3513080
526962
56209280 sq. acres.

Ex. XXXIV. (p. 105.)

(1) £23. 9*s.* 8*d.* (2) £253. 10*s.* 8*d.* (3) £252. 3*s.* $3\frac{3}{4}$*d.*

(4) £153. 16*s.* $3\frac{3}{4}$*d.* (5) £271. 10*s.* (6) £3329. 8*s.* $1\frac{1}{2}$*d.*

(7) 143 tons, 15 cwt., 3 qrs., 18 lbs. (8) 14 lbs , 9 oz., 2 drs., 19 grs.

(9) 223 ac., 3 ro., 15 po.

(10) £241. 18*s.* $7\frac{1}{4}$*d.*; £2778. 6*s.* 11*d.*; £1967. 12*s.* $7\frac{1}{4}$*d.*; £3722. 11*s.* $5\frac{3}{4}$*d.*; £66851. 0*s.* $4\frac{1}{2}$*d.*; £79251. 16*s.* $0\frac{1}{2}$*d.*; £769861. 15*s.* $2\frac{1}{2}$*d.*

(11) 49 lbs., 10 oz., 13 grs.; 193 lbs., 9 oz., 19 dwts.; 1757 lbs., 1 oz., 18 dwts., 14 grs.

(12) 3 oz., 2 drs., 9 grs.; 232 lbs., 4 oz., 4 drs., 1 sc.; 246 lbs., 4 oz., 2 drs.; 17 grs.

(13) 98 lbs., 10 oz., 13 drs.; 2 tons, 13 cwt., 3 qrs., 24 lbs., 8 oz.; 2214 tons, 9 cwt., 2 qrs., 26 lbs.; 153 tons, 9 cwt., 2 qrs., 2 lbs., 2 oz.

(14) 176 yds., 2 ft., 5 in.; 199 m., 2 fur.; 166 m., 7 fur., 13 po., 1 yd., 2 ft., 1 in.; 125 lea., 2 m., 4 fur., 198 yds.

(15) 185 yds., 1 qr., 3 na.; 182 Eng. ells.

(16) 181 ac., 16 po.; 87 ac., 2 ro., 26 po., 14½ sq. yds., 2 sq. ft., 93 sq. in.

(17) 85 c. yds., 9 c. ft., 575 c. in.; 74 po., ¼ sq. yd., 8 sq. ft., 53 sq. in.

(18) 304 gals., 1 qt.; 47 pipes, 55 gals., 1 qt.; 403 hhds., 36 gals., 7 pts.

(19) 260 qrs., 3 pks., 11 pts.; 1702 lds., 6 bus., 1 pk.

(20) 28 mo., 1 wk., 19 hrs., 40 m.; 216 yrs., 39 wks., 6 d., 17 hrs., 51 m., 51 sec.

(21) To find *A*'s age, we must add together the given ages of *B, C, D, E* and add to the result 4 years, since that will be the age of *F* on his 5th birthday:

∴ the result will be 35 yrs., 7 mo., 2 wks., 3 d., 13 hrs.

Ex. XXXV. (p. 107.)

(1)

$$\begin{array}{rrl} \pounds & s. & d. \\ 2 & 0 & 7\frac{2}{3} \\ 12 & 16 & 0\frac{3}{4} \\ 4 & 14 & 8\frac{5}{6} \\ 10 & 0 & 0\frac{1}{2} \\ 1 & 7 & 5\frac{3}{8} \\ 14 & 15 & 7\frac{7}{12} \\ \hline 45 & 14 & 6\frac{17}{24} \end{array}$$

$$\frac{2}{3}+\frac{3}{4}+\frac{5}{6}+\frac{1}{2}+\frac{3}{8}+\frac{7}{12}$$
$$=\frac{16+18+20+12+9+14}{24}$$
$$=\frac{89}{24}=3\tfrac{17}{24}.$$

(2)

$$\begin{array}{rrl} \pounds & s. & d. \\ 20 & 16 & 5\frac{1}{9} \\ 14 & 15 & 0\frac{2}{7} \\ 5 & 13 & 8\frac{13}{21} \\ 33 & 19 & 1\frac{1}{3} \\ 18 & 3 & 4\frac{5}{7} \\ \hline 93 & 7 & 8\frac{4}{63} \end{array}$$

$$\frac{1}{9}+\frac{2}{7}+\frac{13}{21}+\frac{1}{3}+\frac{5}{7}$$
$$=\frac{7+18+39+21+45}{63}$$
$$=\frac{130}{63}=2\tfrac{4}{63}.$$

(3)

$$\begin{array}{rrl} \pounds & s. & d. \\ 1 & 3 & 6\frac{2}{3} \\ 2 & 4 & 7\frac{9}{10} \\ 3 & 5 & 8\frac{5}{6} \\ 4 & 9 & 1\frac{13}{15} \\ 6 & 16 & 6\frac{19}{25} \\ \hline 17 & 19 & 8\frac{2}{75} \end{array}$$

$$\frac{2}{3}+\frac{9}{10}+\frac{5}{6}+\frac{13}{15}+\frac{19}{25}$$
$$=\frac{100+135+125+130+114}{150}$$
$$=\frac{604}{150}=4\tfrac{4}{150}=4\tfrac{2}{75}.$$

(4)

$$\begin{array}{rrl} \pounds & s. & d. \\ 23 & 6 & 0\frac{7}{8} \\ 4 & 0 & 9\frac{1}{2} \\ 57 & 17 & 8\frac{15}{16} \\ 96 & 19 & 11\frac{5}{12} \\ 157 & 7 & 7\frac{11}{24} \\ \hline 339 & 12 & 2\frac{3}{16} \end{array}$$

$$\frac{7}{8}+\frac{1}{2}+\frac{15}{16}+\frac{5}{12}+\frac{11}{24}$$
$$=\frac{42+24+45+20+22}{48}$$
$$=\frac{153}{48}=3\tfrac{9}{48}=3\tfrac{3}{16}.$$

	£	*s.*	*d.*
(5)	273	16	$7\frac{19}{20}$
	370	11	$8\frac{4}{5}$
	621	18	$9\frac{1}{4}$
	197	4	$11\frac{3}{8}$
			$5\frac{9}{10}$
	1463	7	$2\frac{11}{40}$

$$\frac{19}{20}+\frac{4}{5}+\frac{1}{4}+\frac{3}{8}+\frac{9}{10}$$
$$=\frac{38+32+10+15+36}{40}$$
$$=\frac{131}{40}=3\frac{11}{40}.$$

Ex. XXXVI. (p. 109.)

1. £20. 8*s.* 10*d.* **2.** £62. 11*s.* 4*d.* **3.** £189. 14*s.* $0\frac{1}{2}$*d.*

4. £888. 0*s.* $2\frac{1}{2}$*d.* **5.** £331. 19*s.* $11\frac{1}{2}$*d.* **6.** £313. 6*s.* $1\frac{3}{4}$*d.*

7. 4 cwt., 3 qrs., 5 lbs., 7 oz. **8.** 12 fur., 36 po., 1 yd.

9. 5 ac., 2 ro., 31 po. **10.** 55 qrs., 5 bus., 1 pk., 1 gal.

11. £77. 17*s.* $10\frac{3}{4}$*d.*

12. (1) 38 lbs., 4 oz., 9 dwts., 10 grs. (2) 859 lbs., 4 oz., 6 dwts., 5 grs.

(3) 6 tons, 16 cwt., 3 qrs., 5 lbs. (4) 17 tons, 13 cwt., 3 qrs., 19 lbs.

(5) 15 lbs., 8 oz., 4 drs., 1 sc. (6) 30 yds., 1 qr., 2 na.

(7) 1 yd., 1 ft., 10 in. (8) 11 yds., 1 ft., 1 in.

(9) 1 m., 5 fur., 36 po., 5 yds. (10) 6 lea., 2 m., 6 fur., 23 po., 4 yds., 2 ft.

(11) 7 ac., 2 ro., 36 po. (12) 1 ro., 28 po., 28 sq. yds., 8 sq. ft.

(13) 1 cub. yd. 20 cub. ft. 1305 cub. in. (14) 15 tuns, 2 hhds., 53 gals., 1 qt., 1 pt.

(15) 5 bar., 3 fir., 3 qts. (16) 4 lds., 4 qrs., 7 bus., 3 pks.

(17) 2 mo., 1 wk., 3 d. (18) 9°, $36'$, $55''$.

(19) £52. 0*s.* $4\frac{1}{4}$*d.*

	£	*s.*	*d.*	
(20)	4759	10	$9\frac{1}{4}$	value of furnished house.
	1494	11	$9\frac{3}{4}$	.... unfurnished house.
	3264	18	$11\frac{1}{2}$	value of furniture.
	1494	11	$9\frac{3}{4}$	value of house.
	1770	7	$1\frac{3}{4}$	value of furniture above value of house.

Ex. XXXVII. (p. 111.)

(1)
$$\begin{array}{rrr} £ & s. & d. \\ 3 & 13 & 9\frac{3}{4} \\ 2 & 15 & 5\frac{1}{6} \\ \hline & 18 & 4\frac{7}{12} \end{array}$$

$$\frac{3}{4}-\frac{1}{6}=\frac{9-2}{12}=\frac{7}{12}.$$

(2)
$$\begin{array}{rrr} £ & s. & d. \\ 20 & 0 & 0 \\ 15 & 15 & 0\frac{6}{7} \\ \hline 4 & 4 & 11\frac{1}{7} \end{array}$$

(3)
$$\begin{array}{rrr} £ & s. & d. \\ 23 & 13 & 7\frac{1}{5} \\ 19 & 19 & 7\frac{3}{5} \\ \hline 3 & 13 & 11\frac{3}{5} \end{array}$$

(4)
$$\begin{array}{rrr} £ & s. & d. \\ 416 & 10 & 5\frac{1}{2} \\ 305 & 11 & 9\frac{5}{8} \\ \hline 110 & 18 & 7\frac{7}{8} \end{array}$$

$$1\frac{1}{2}-\frac{5}{8}=\frac{3}{2}-\frac{5}{8}$$
$$=\frac{12-5}{8}=\frac{7}{8}.$$

(5)
$$\begin{array}{rrr} £ & s. & d. \\ 2163 & 1 & 7\frac{5}{12} \\ 364 & 2 & 5\frac{13}{16} \\ \hline 1798 & 19 & 1\frac{29}{48} \end{array}$$

$$1\frac{5}{12}-\frac{13}{16}=\frac{17}{12}-\frac{13}{16}$$
$$=\frac{68-39}{48}=\frac{29}{48}.$$

Ex. XXXVIII. (p. 112.)

(1)
$$\begin{array}{rrr} £ & s. & d. \\ 11 & 13 & 6 \\ & & 2 \\ \hline 23 & 7 & 0 \end{array} \qquad \begin{array}{rrr} £ & s. & d. \\ 11 & 13 & 6 \\ & & 5 \\ \hline 58 & 7 & 6 \end{array}$$

(2)
$$\begin{array}{rrr} £ & s. & d. \\ 2 & 18 & 7\frac{1}{2} \\ & & 4 \\ \hline 11 & 14 & 6 \end{array} \qquad \begin{array}{rrr} £ & s. & d. \\ 2 & 18 & 7\frac{1}{2} \\ & & 6 \\ \hline 17 & 11 & 9 \end{array}$$

(3)
$$\begin{array}{rrr} £ & s. & d. \\ 1 & 16 & 6\frac{1}{4} \\ & & 7 \\ \hline 12 & 15 & 7\frac{3}{4} \end{array} \qquad \begin{array}{rrr} £ & s. & d. \\ 1 & 16 & 6\frac{1}{4} \\ & & 9 \\ \hline 16 & 8 & 8\frac{1}{4} \end{array}$$

(4)
$$\begin{array}{rrr} £ & s. & d. \\ 2 & 15 & 2\frac{3}{4} \\ & & 5 \\ \hline 13 & 6 & 1\frac{3}{4} \end{array} \qquad \begin{array}{rrr} £ & s. & d. \\ 2 & 15 & 2\frac{3}{4} \\ & & 8 \\ \hline 22 & 1 & 10 \end{array}$$

(5)
$$\begin{array}{rrr} £ & s. & d. \\ 3 & 16 & 0\frac{3}{4} \\ & & 11 \\ \hline 41 & 16 & 8\frac{1}{4} \end{array} \qquad \begin{array}{rrr} £ & s. & d. \\ 3 & 16 & 0\frac{3}{4} \\ & & 12 \\ \hline 45 & 12 & 9 \end{array}$$

(6)
$$\begin{array}{rrr} £ & s. & d. \\ 7 & 19 & 7\frac{1}{2} \\ & & 10 \\ \hline 79 & 16 & 3 \end{array} \qquad \begin{array}{rrr} £ & s. & d. \\ 7 & 19 & 7\frac{1}{2} \\ & & 12 \\ \hline 95 & 15 & 6 \end{array}$$

(7)

£	s.	d.	
347	15	9¾	
		3	
1043	7	5¼	

£	s.	d.	
347	15	9¾	
		11	
3825	13	11¼	

(8)

£	s.	d.	
583	0	10	
		12	
6996	10	0	for 12
583	0	10	for 1
7579	10	10	for 13

£	s.	d.	
583	0	10	
		2	
1166	1	8	for 2
		8	
9328	13	4	for 16

(9)

£	s.	d.	
1875	13	8¾	
		3	
5627	1	2¼	for 3
		7	
39389	8	3¾	for 21

£	s.	d.	
1875	13	8¾	
		8	
15005	9	10	for 8
		8	
120043	18	8	for 64

(10)

£	s.	d.	
721	0	5¼	
		9	
6489	3	11¼	for 9
		9	
58402	15	5¼	for 81

£	s.	d.	
721	0	5¼	
		8	
5768	3	6	for 8
		12	
69218	2	0	for 96

11)

£	s.	d.	
5072	12	8½	
		10	
50726	7	1	for 10
		11	
557989	17	11	for 110
10145	5	5	for 2
568135	3	4	for 112

£	s.	d.	
5072	12	8½	
		10	
50726	7	1	for 10
		12	
608716	5	0	for 120
40581	1	8	for 8
649297	6	8	for 128

12)

£	s.	d.	
1100	11	9¼	
		6	
6603	10	7½	for 6
		10	
66035	6	3	for 60
2201	3	6½	for 2
68236	9	9½	for 62

£	s.	d.	
1100	11	9¼	
		10	
11005	17	8½	for 10
		8	
88047	1	8	for 80
2201	3	6½	for 2
90248	5	2½	for 82

£	s.	d.	
1100	11	9¼	
		10	
11005	17	8½	for 10
		9	
99052	19	4½	for 90
3301	15	3¾	for 3
102354	14	8¼	for 93

Ex. XXXVII. (p. 111.)

(1)

£	s.	d.
3	13	$9\frac{3}{4}$
2	15	$5\frac{1}{6}$
	18	$4\frac{7}{12}$

$$\frac{3}{4}-\frac{1}{6}=\frac{9-2}{12}=\frac{7}{12}.$$

(2)

£	s.	d.
20	0	0
15	15	$0\frac{6}{7}$
4	4	$11\frac{1}{7}$

(3)

£	s.	d.
23	13	$7\frac{1}{5}$
19	19	$7\frac{3}{5}$
3	13	$11\frac{3}{5}$

(4)

£	s.	d.
416	10	$5\frac{1}{2}$
305	11	$9\frac{5}{8}$
110	18	$7\frac{7}{8}$

$$1\frac{1}{2}-\frac{5}{8}=\frac{3}{2}-\frac{5}{8}$$
$$=\frac{12-5}{8}=\frac{7}{8}.$$

(5)

£	s.	d.
2163	1	$7\frac{5}{12}$
364	2	$5\frac{13}{16}$
1798	19	$1\frac{29}{48}$

$$1\frac{5}{12}-\frac{13}{16}=\frac{17}{12}-\frac{13}{16}$$
$$=\frac{68-39}{48}=\frac{29}{48}.$$

Ex. XXXVIII. (p. 112.)

(1)

£	s.	d.
11	13	6
		2
23	7	0

£	s.	d.
11	13	6
		5
58	7	6

(2)

£	s.	d.
2	18	$7\frac{1}{2}$
		4
11	14	6

£	s.	d.
2	18	$7\frac{1}{2}$
		6
17	11	9

(3)

£	s.	d.
1	16	$6\frac{1}{4}$
		7
12	15	$7\frac{3}{4}$

£	s.	d.
1	16	$6\frac{1}{4}$
		9
16	8	$8\frac{1}{4}$

(4)

£	s.	d.
2	15	$2\frac{3}{4}$
		5
13	6	$1\frac{3}{4}$

£	s.	d.
2	15	$2\frac{3}{4}$
		8
22	1	10

(5)

£	s.	d.
3	16	$0\frac{3}{4}$
		11
41	16	$8\frac{1}{4}$

£	s.	d.
3	16	$0\frac{3}{4}$
		12
45	12	9

(6)

£	s.	d.
7	19	$7\frac{1}{2}$
		10
79	16	3

£	s.	d.
7	19	$7\frac{1}{2}$
		12
95	15	6

(7)

£	s.	d.
347	15	9¾
		3
1043	7	5¼

£	s.	d.
347	15	9¾
		11
3825	13	11¼

(8)

£	s.	d.	
583	0	10	
		12	
6996	10	0	for 12
583	0	10	for 1
7579	10	10	for 13

£	s.	d.	
583	0	10	
		2	
1166	1	8	for 2
		8	
9328	13	4	for 16

(9)

£	s.	d.	
1875	13	8¾	
		3	
5627	1	2¼	for 3
		7	
39389	8	3¾	for 21

£	s.	d.	
1875	13	8¾	
		8	
15005	9	10	for 8
		8	
120043	18	8	for 64

(10)

£	s.	d.	
721	0	5¼	
		9	
6489	3	11¼	for 9
		9	
58402	15	5¼	for 81

£	s.	d.	
721	0	5¼	
		8	
5768	3	6	for 8
		12	
69218	2	0	for 96

(11)

£	s.	d.	
5072	12	8½	
		10	
50726	7	1	for 10
		11	
557989	17	11	for 110
10145	5	5	for 2
568135	3	4	for 112

£	s.	d.	
5072	12	8½	
		10	
50726	7	1	for 10
		12	
608716	5	0	for 120
40581	1	8	for 8
649297	6	8	for 128

(12)

£	s.	d.	
1100	11	9¼	
		6	
6603	10	7½	for 6
		10	
66035	6	3	for 60
2201	3	6½	for 2
68236	9	9½	for 62

£	s.	d.	
1100	11	9¼	
		10	
11005	17	8½	for 10
		8	
88047	1	8	for 80
2201	3	6½	for 2
90248	5	2½	for 82

£	s.	d.	
1100	11	9¼	
		10	
11005	17	8½	for 10
		9	
99052	19	4½	for 90
3301	15	3¾	for 3
102354	14	8¼	for 93

(25)

bar.	gal.	qt.	pt.	
43	14	1	1	
			4	
173	17	2	0	for 4
			9	
1561	13	2	0	for 36
130	4	0	1	for 3
1691	17	2	1	for 39

bar.	gal.	qt.	pt.	
43	13	1	1	
			10	
433	25	3	0	for 10
			10	
4337	5	2	0	for 100
			7	
30360	2	2	0	for 700
2602	10	2	0	for 60
173	17	2	0	for 4
33135	30	2	0	for 764

(26)

£	s.	d.	
1	0	9½	
		10	
10	7	11	for 10
		6	
62	7	6	for 60
7	5	6½	for 7
69	13	0½	cost of lambs.

£	s.	d.	
2	2	11¼	
		10	
21	9	4½	for 10
		7	
150	5	7½	for 70
6	8	9¾	for 3
156	14	5¼	cost of sheep.

£	s.	d.	
37	0	2¾	
		4	
148	0	11	cost of cows.

£	s.	
38	17	
	5	
194	5	for 5
	3	
582	15	for 15
77	14	for 2
660	9	cost of horses.

£	s.	d.	
69	13	0½	cost of lambs.
156	14	5¼	.... sheep.
148	0	11	.... cows.
660	9	0	.... horses.
18	7	6	expenses.
1053	4	10¾	whole outlay.

(27)

7 chests.
18
126 drawers.
8
1008 divisions.

£	s.	d.	
16	6	8	
		10	
163	6	8	for 10
		10	
1633	6	8	for 100
		10	
16333	6	8	for 1000
130	13	4	for 8
16464	0	0	for 1008.

Ex. XXXIX. (p. 114.)

(1)

£	s.	d.
6	12	8⅝
		3
19	18	2½

£	s.	d.
6	12	8⅝
		11
73	0	1⅛

£	s.	d.	
6	12	8⅝	
		6	
39	16	5	for 6
		9	
358	7	9	for 54
19	18	2½	for 3
378	5	11½	for 57.

(2)

£	s.	d.	
75	13	$9\frac{1}{5}$	
		4	
302	15	$0\frac{4}{5}$	

£	s.	d.	
75	13	$9\frac{1}{5}$	
		5	
378	8	10	for 5
		3	
1135	6	6	for 15.

£	s.	d.	
75	13	$9\frac{1}{5}$	
		11	
832	11	$5\frac{1}{5}$	for 11
		8	
6660	11	$5\frac{3}{5}$	for 88.

(5)

£	s.	d.	
125	19	$11\frac{11}{16}$	
		8	
1007	19	$9\frac{1}{2}$	for 8
		6	
6047	18	9	for 48.

£	s.	d.	
125	19	$11\frac{11}{16}$	
		12	
1511	19	$8\frac{1}{4}$	for 12
		12	
18143	16	3	for 144.

£	s.	d.	
125	19	$11\frac{11}{16}$	
		10	
1259	19	$8\frac{7}{8}$	for 10
		10	
12599	17	$4\frac{3}{4}$	for 100
		5	
62999	6	$11\frac{3}{4}$	for 500
8819	18	$2\frac{1}{8}$	for 70
881	19	$9\frac{13}{16}$	for 7
72701	4	$11\frac{11}{16}$	for 577.

(3)

£	s.	d.	
709	17	$11\frac{11}{12}$	
		6	
4259	7	$11\frac{1}{2}$	

£	s.	d.	
709	17	$11\frac{11}{12}$	
		12	
8518	15	11	for 12
		2	
17037	11	10	for 24
1419	15	$11\frac{5}{6}$	for 2
18457	7	$9\frac{5}{6}$	for 26.

£	s.	d.	
709	17	$11\frac{11}{12}$	
		12	
8518	15	11	for 12
		10	
85187	19	2	for 120.

(4)

£	s.	d.	
525	14	$0\frac{5}{8}$	
		6	
3154	4	$3\frac{3}{4}$	for 6
		7	
22079	10	$2\frac{1}{4}$	for 42.

£	s.	d.	
525	14	$0\frac{5}{8}$	
		4	
2102	16	$2\frac{1}{2}$	for 4
		11	
23130	18	$3\frac{1}{2}$	for 44.

£	s.	d.	
525	14	$0\frac{5}{8}$	
		10	
5257	0	$6\frac{1}{4}$	for 10
		10	
52570	5	$2\frac{1}{2}$	for 100
31542	3	$1\frac{1}{2}$	for 60
1577	2	$1\frac{7}{8}$	for 3
85689	10	$5\frac{7}{8}$	for 163.

Ex. XL. (p. 116.)

(1)
£ s. d.
2 | 7 16 2
3 18 1

(2)
£ s. d.
3 | 6 8 9
2 2 11

(3)
£ s. d.
2 | 75 8 6½
37 14 3¼

(4)
£ s. d.
3 | 19 14 9¾
6 11 7¼

(5)
£ s. d.
4 | 245 14 8
61 8 8

(6)
£ s. d.
5 | 86 16 5½
17 7 3½

(7)
£ s. d.
6 | 82 13 7½
13 15 7¼

(8)
£ s. d.
7 | 435 17 2¼
62 5 3¾

(9)
£ s. d.
8 | 409 6 2
51 3 3¼

(10)
£ s. d.
9 | 605 0 1½
67 4 5½

(11)
£ s. d.
11 | 386 16 5¼
35 3 3¾

(12)
£ s. d.
12 | 473 14 6
39 9 6½

(13)
£ s. d.
23) 33 . 18 . 6 (£1
23
10
20
23) 218 (9s.
207
11
12
23) 138 (6d.
138

Ans. £1. 9s. 6d.

(14)
£ s. d.
31) 39 . 1 . 5½ (£1
31
8
20
31) 161 (5s.
155
6
12
31) 77 (2d.
62
15
4
31) 62 (2q.
62

Ans. £1. 5s. 2½d.

(15)
£ s. d.
39) 12 . 18 . 4½
20
39) 258 (6s.
234
24
12
39) 292 (7d.
273
19
4
39) 78 (2q.
78

Ans. 6s. 7½d.

(16)
£ s. d.
139) 165 . 15 . 8¾ (£1
139
26
20
139) 535 (3s.
417
118
12
139) 1424 (10d.
1390
34
4
139) 139 (1q.
139

Ans. £1. 3s. 10¼d.

(17)
£ s. d.
198) 62 . 1 . 7½
20
198) 1241 (6s.
1188
53
12
198) 643 (3d.
594
49
4
198) 198 (1q.
198

Ans. 6s. 3¼d.

(18)
£
744)2728(£3
2232
496
20
744)9920(13s.
744
2480
2232
248
12
744)2976(4d.
2976

Ans. £3. 13s. 4d.

(20)
£ s. d.
74)37 . 3 . 1
20
74)743(10s.
740
3
12
74)37(0d.
4
74)148(2q.
148

Ans. 10s. 0½d.

(21)
£ s. d.
6352)492710 . 1 . 8(£77
44464
48070
44464
3606
20
6352)72121(11s.
69872
2249
12
6352)26996(4d.
25408
1588
4
6352)6352(1q.
6352

Ans. £77. 11s. 4¼d.

(19)
£ s. d.
754)1288 . 1 . 8(£1
754
534
20
754)10681(14s.
754
3141
3016
125
12
754)1508(2d.
1508

Ans. £1. 14s. 2d.

(22)
£ s. d.
156)162 . 3 . 6(£1
156
6
20
156)123(0s.
12
156)1482(9d.
1404
78
4
156)312(2q.
312

Ans. £1. 0s. 9½d.

(23)
£ s. d.
9416)130264 . 9 . 6(£13
9416
36104
28248
7856
20
9416)157129(16s.
9416
62969
56496
6473
12
9416)77682(8d.
75328
2354
4
9416)9416(1q.
9416

Ans. £13. 16s. 8¼d.

(24)
£
2737) 1746
20
2737) 34920 (12*s.*
32844
2076
12
2737) 24912 (9*d.*
24633
279

Ans. 12*s.* $9\frac{279}{2737}$*d.*

(25)
£ . *s.* . *d.*
357) 2648 . 18 . 9 (£7
2499
149
20
357) 2998 (8*s.*
2856
142
12
357) 1713 (4*d.*
1428
285
4
357) 1140 (3*q.*
1071
69

and $\frac{69}{357} = \frac{23}{119}$;

∴ *Ans.* £7. 8*s.* $4\frac{3}{4}$*d.* $\frac{23}{119}$*q.*

(26)
£ . *s.* . *d.*
129) 844 . 0 . $8\frac{1}{4}$ (£2
258
86
20
129) 1720 (13*s.*
129
430
387
43
12
129) 524 (4*d.*
516
8
4
33*q.*

∴ since $\frac{33}{129} = \frac{11}{43}$,

Ans. = £2. 13*s.* 4*d.* $\frac{11}{43}$*q.*

(27)
cwt. . lbs.
75) 1283 . 4 (17 cwt.
75
533
525
8
112
75) 900 (12 lbs.
900

Ans. 17 cwt. 12 lbs.

(28)
cwt. . qrs. . lbs.
53) 178 . 3 . 14 (3 cwt.
159
19
4
53) 79 (1 qr.
53
26
28
222
52
53) 742 (14 lbs.
53
212
212

Ans. 3 cwt. 1 qr. 14 lbs.

(29)
mo. . d.
26) 206 . 4 (7 mo.
182
24
28
196
48
26) 676 (26 d.
52
156
156

Ans. 7 mo. 26 d.

(30)
d. h. m.
47) 684 . 8 . 9 (14 d.
47
214
188
26
24
112
52
47) 632 (13 h.
47
162
141
21
60
47) 1269 (27 m.
94
329
329
Ans. 14 d. 13 h. 27 m.

(33)
ac. r. p.
26) 75 . 3 . 39 (2 ac.
52
23
4
26) 95 (3 r.
78
17
40
26) 719 (27 p.
52
199
182
17
$30\frac{1}{4}$
510
$4\frac{1}{4}$
26) $514\frac{1}{4}$ (19 sq. yds.
26
$254\frac{1}{4}$
234
$20\frac{1}{4}$
9
26) $182\frac{1}{4}$ (7 sq. ft.
182
$\frac{1}{4}$
144
26) 36 (1 sq. in.
26
10
Ans. 2 ac. 3 r. 27 p. 19 sq. yds.
7 sq. ft. $1\frac{5}{13}$ sq. in.

(31)
cwt. lbs. oz.
456) 15 . 27 . 11
4
60 qrs.
28
507
120
456) 1707 (3 lbs.
1368
339
16
2045
339
456) 5435 (11 oz.
5016
419
16
2514
419
456) 6704 (14 drs.
456
2144
1824
320
∴ since $\frac{320}{456} = \frac{40}{57}$,
Ans. = 3 lbs. 11 oz. $14\frac{40}{57}$ drs.

(32)
cwt.
963) 76
112
152
76
76
963) 8512 (8 lbs.
7704
808
16
4848
808
963) 12928 (13 oz.
963
3298
2889
409
16
2454
409
963) 6544 (6 drs.
5778
766
Ans. 8 lbs. 13 oz. $6\frac{766}{963}$ drs.

(34)
ac. r.
147)13 . 1
4
53 r.
40
147)2120(14 p.
147
650
588
62
$30\frac{1}{4}$
1860
$15\frac{1}{2}$
147)$1875\frac{1}{2}$(12 sq. yds.
1764
$111\frac{1}{2}$
9
147)$1003\frac{1}{2}$(6 sq. ft.
882
$121\frac{1}{2}$
144
484
484
121
72
147)17496(119 sq. inch.
147
279
147
1326
1323
3

Ans. 14 po. 12 sq. yds. 6 sq. ft. $119\frac{1}{49}$.

(35)
yds. qrs. na.
903)91 . 2 . 1
4
366
4
903)1465(1 na.
903
562

Ans. $1\frac{562}{903}$ na.

(36)
qrs. bush. pks.
107)97 . 3 . 3
8
107)779(7 bus.
749
30
4
107)123(1 pk.
107
16

Ans. 7 bus. $1\frac{16}{107}$ pk.

(37)
£ £
·000625)12·000000(19200
625
5750
5625
1250
1250
00

£ £
·001875)36·000000(19200
1875
17250
16875
3750
3750
00

Ex. XLI. (p. 117.)

(1)
£ s. d.
15) 440 . 16 . $9\frac{1}{2}$ (£29
30
140
135
5
20
15) 116 (7*s.*
105
11
12
15) 141 (9*d.*
135
6
4
15) 26 (1*q.*
15
11

Or,

£ s. d.
15 { 3 | 440 16 $9\frac{1}{2}$
15 { 5 | 146 18 11 . $\frac{2}{3}$
29 7 $9\frac{1}{4}$. $\frac{11}{15}$

(2)
£ s. d.
32) 678 . 19 . $9\frac{3}{4}$ (£21
64
38
32
6
20
32) 139 (4*s.*
128
11
12
32) 141 (4*d.*
128
13
4
32) 55 (1*q.*
32
23

Or thus:

£ s. d.
32 { 4 | 678 19 $9\frac{3}{4}$
32 { 8 | 169 14 $11\frac{1}{4}$. $\frac{3}{4}$
21 4 $4\frac{1}{4}$. $\frac{23}{32}$

(3)
£ s. d.
99) 123 . 13 . $0\frac{3}{4}$ (£1
99
24
20
99) 493 (4*s.*
396
97
12
99) 1164 (11*d.*
1089
75
4
99) 303 (3*q.*
297
6

Or thus:

£ s. d.
99 { 11 | 123 13 $0\frac{3}{4}$
99 { 9 | 11 4 $9\frac{3}{4}$. $\frac{6}{11}$
1 4 $11\frac{3}{4}$. $\frac{2}{33}$

(4)
£ s.
96) 236 . 17 (£2
192
44
20
96) 897 (9*s.*
864
33
12
96) 396 (4*d.*
384
12

Or thus:

£ s. d.
96 { 12 | 236 17 0
96 { 8 | 19 4 9
2 9 4 . $\frac{1}{8}$

(5)

$$\begin{array}{rl}
 & \pounds \quad\ s. \quad d. \\
18) & 371\ .\ 2\ .\ 9\tfrac{1}{4}\ (\pounds 20 \\
 & \underline{36} \\
 & 11 \\
 & \underline{20} \\
18) & 222\ (12s. \\
 & \underline{216} \\
 & 6 \\
 & \underline{12} \\
18) & 81\ (4d. \\
 & \underline{72} \\
 & 9 \\
 & \underline{4} \\
18) & 37\ (2q. \\
 & \underline{36} \\
 & 1
\end{array}$$

Or thus:

$$18\begin{cases}2\\9\end{cases}\begin{array}{|rrl}
\pounds & s. & d. \\
371 & 2 & 9\tfrac{1}{4} \\ \hline
185 & 11 & 4\tfrac{1}{2}\ .\ \tfrac{1}{2} \\ \hline
20 & 12 & 4\tfrac{1}{2}\ .\ \tfrac{1}{18}
\end{array}$$

(6)

$$\begin{array}{rl}
 & \pounds \quad\ s. \quad d. \\
42) & 315\ .\ 11\ .\ 7\tfrac{1}{4}\ (\pounds 7 \\
 & \underline{294} \\
 & 21 \\
 & \underline{20} \\
42) & 431\ (10s. \\
 & \underline{420} \\
 & 11 \\
 & \underline{12} \\
42) & 139\ (3d. \\
 & \underline{126} \\
 & 13 \\
 & \underline{4} \\
42) & 53\ (1q. \\
 & \underline{42} \\
 & 11
\end{array}$$

Or thus:

$$42\begin{cases}6\\7\end{cases}\begin{array}{|rrl}
\pounds & s. & d. \\
315 & 11 & 7\tfrac{1}{4} \\ \hline
52 & 11 & 11\ .\ \tfrac{5}{6} \\ \hline
7 & 10 & 3\tfrac{1}{4}\ .\ \tfrac{11}{42}
\end{array}$$

(7)

$$\begin{array}{rl}
 & \pounds \quad\ s. \quad d. \\
132) & 972\ .\ 15\ .\ 10\tfrac{1}{2}\ (\pounds 7 \\
 & \underline{924} \\
 & 48 \\
 & \underline{20} \\
132) & 975\ (7s. \\
 & \underline{924} \\
 & 51 \\
 & \underline{12} \\
132) & 622\ (4d. \\
 & \underline{528} \\
 & 94 \\
 & \underline{4} \\
132) & 378\ (2q. \\
 & \underline{264} \\
 & 114
\end{array}$$

and $\frac{114}{132}=\frac{19}{22}$.

Or thus:

$$132\begin{cases}12\\11\end{cases}\begin{array}{|rrl}
\pounds & s. & d. \\
972 & 15 & 10\tfrac{1}{2} \\ \hline
81 & 1 & 3\tfrac{3}{4}\ .\ \tfrac{1}{2} \\ \hline
7 & 7 & 4\tfrac{1}{2}\ .\ \tfrac{19}{22}
\end{array}$$

(8)

$$\begin{array}{rl}
 & \pounds \quad\ s. \quad d. \\
198) & 860\ .\ 11\ .\ 1\tfrac{1}{4}\ (\pounds 4 \\
 & \underline{792} \\
 & 68 \\
 & \underline{20} \\
198) & 1371\ (6s. \\
 & \underline{1188} \\
 & 183 \\
 & \underline{12} \\
198) & 2197\ (11d. \\
 & \underline{2178} \\
 & 19 \\
 & \underline{4} \\
 & 77
\end{array}$$

and $\frac{77}{198}=\frac{7}{18}$.

Or thus:

$$198\begin{cases}2\\11\\9\end{cases}\begin{array}{|rrl}
\pounds & s. & d. \\
860 & 11 & 1\tfrac{1}{4} \\ \hline
430 & 5 & 6\tfrac{1}{2}\ .\ \tfrac{1}{2} \\ \hline
39 & 2 & 3\tfrac{3}{4}\ .\ \tfrac{1}{2} \\ \hline
4 & 6 & 11\ .\ \tfrac{7}{18}
\end{array}$$

(9)

£ s. d.

108) 2016 . 2 . 2$\frac{1}{4}$ (£18
108
936
864
72
20
108) 1442 (13*s.*
108
362
324
38
12
108) 458 (4*d.*
432
26
4
105

and $\frac{105}{108}=\frac{35}{36}$.

Or thus:

$$108\left\{\begin{array}{r|rrl} & \pounds & s. & d. \\ 12 & 2016 & 2 & 2\frac{1}{4} \\ \hline 9 & 168 & 0 & 2-\frac{3}{4} \\ \hline & 18 & 13 & 4-\frac{35}{36} \end{array}\right.$$

(10)

£ s. d.

528) 3363 . 0 . 11$\frac{3}{4}$ (£6
3168
195
20
528) 3900 (7*s.*
3696
204
12
528) 2459 (4*d.*
2112
347
4
528) 1391 (2*q.*
1056
335

Or thus:

$$528\left\{\begin{array}{r|rrl} & \pounds & s. & d. \\ 4 & 3363 & 0 & 11\frac{3}{4} \\ \hline 12 & 840 & 15 & 2\frac{3}{4}\,.\,\frac{3}{4} \\ \hline 11 & 70 & 1 & 3-\frac{47}{48} \\ \hline & 6 & 7 & 4\frac{1}{2}\,.\,\frac{335}{528} \end{array}\right.$$

Ex. XLII. (p. 119.)

(1)

£ s. d.
39·6 . 9 . 2
20
s. 12·9
12
d. 11·0

Ans. £39. 12*s.* 11*d.*

(2)

£ s.
17·87 . 10
20
s. 17·50
12
d. 6·00

Ans. £17. 17*s.* 6*d.*

(3)

£
2·025
20
s. ·500
12
d. 6·000

Ans. £2. 0*s.* 6*d.*

(4)

£ s. d.
1·447 . 18 . 4
20
s. 8·958
12
d. 11·500
4
q. 2·000

Ans. £1. 8*s.* 11$\frac{1}{2}$*d.*

(5)

$$24\left\{\begin{array}{r|rrr} & \pounds & s. & d. \\ 4 & 262 & 10 & 0 \\ \hline 6 & 65 & 12 & 6 \\ \hline & \pounds\ \cdot 10 & 18 & 9 \end{array}\right.$$

20
s. 2·18
12
d. 2·25
4
q. 1·00

Ans. 2*s.* 2$\frac{1}{4}$*d.*

(6)

$$25\left\{\begin{array}{r|rrr} & \pounds & s. & d. \\ 5 & 26380 & 4 & 2 \\ \hline 5 & 5276 & 0 & 10 \\ \hline & \pounds\ 1\cdot 055 & 4 & 2 \end{array}\right.$$

20
s. 1·104
12
d. 1·250
4
q. 1·000

Ans. £1. 1*s.* 1$\frac{1}{4}$*d.*

(7)
ac. ro. po.
21 3 17
2
·43 2 34
4
ro. 1·74
40
po. 29·94
Ans. 1 ro. 29·94 po.

£ s.
375 . 3
20
7503
·0507
5·2521
375·15
s. 380·4021
12
d. 4·8252
4
q. 3·3008
Ans. £19. 0*s.* 4¾*d.* ·3008.

(8)
ac. ro. po.
24 3 10
2
49 2 20
8
397 0 0
7
ac. 2779 0 0 for 112.

ac.
277·9 for 11·2
4
ro. 3·6
40
po. 24·0
Ans. 277 ac. 3 ro. 24 po.

Ex. XLIII. (p. 120.)

(1)
s. *d.*
1 . 4½
12
16
2
33

£ *s.* *d.*
2 . 12 . 3
20
52
12
627
2
33 {3 | 1254
{11 | 418
Ans. 38

(2)
£ *s.* *d.*
2 . 8 . 7¾
20
48
12
583
4
2335

£ *s.* *d.*
55 . 18 . 10¼
20
1118
12
13426
4
2335) 53705 (23 *Ans.*
4670
7005
7005

(3)
£ *s.* *d.*
1 . 10 . 6¼
20
30
12
366
4
1465

£ *s.* *d.*
160 . 4 . 8¼
20
3204
12
38456
4
1465) 153825 (105 *Ans.*
1465
7325
7325

(4)
£ *s.* *d.*
2 . 11 . 5¼
20
51
12
617
4
2469

£ *s.* *d.*
401 . 4 . 3
20
8024
12
96291
4
2469) 385164 (156 *Ans.*
2469
13826
12345
14814
14814

(5) cwt. qrs. lbs.
1 . 2 . 17
4
6
28
185

cwt. qrs. lbs.
44 . 2 . 11
4
178
28
1435
356
185) 4995 (27 *Ans.*
370
1295
1295

(6) yds. qrs. na.
7 . 2 . 1
4
30
4
121

yds. qr.
272 . 1
4
1089
4
121) 4356 (36 *Ans.*
363
726
726

(7) bus. pks.
143 . 3
4
575

bus. pks.
9487 . 2
4
575) 37950 (66 *Ans.*
3450
3450
3450

(8) ac. ro. po.
4 . 3 . 27
4
19
40
787

ac. ro. po.
1416 . 2 . 16
4
5666
40
787) 226656 (288 *Ans.*
1574
6925
6296
6296
6296

(9) fur. yds. ft. in.
7 . 87 . 1 . 5
220
1627
3
4882
12
58589

lea. mi. yds.
57 . 19 . 56
3
172
1760
10320
1204
172
956
303676
3
911028
12
58589) 10932336 (186
58589
507343
468712
386316
351534
34782

∴ *Ans.* = $186\frac{34782}{58589}$.

(10) qrs. pk.
12 . 1
8
96 bus.
4
385

lds. qr.
617 . 1
5
3086
8
24688
4
385) 98752 (256
770
2175
1925
2502
2310
192

∴ *Ans.* = $256\frac{192}{385}$.

Ex. XLIV. (p. 121.)

(1)
£ *s.* *d.* £ *s.* *d.*
13 12 11¼ × 2 = 27 5 10½

$\dfrac{13 \quad 12 \quad 11\frac{1}{4} \times 7}{9} = 10 \quad 12 \quad 3\frac{1}{4} . \frac{2}{3}$

Ans. = 37 18 1¾ . ⅔

(2)
£ s. d. £ s. d.
7 0 $0\frac{4}{5} \times 3 = 21$ 0 $2\frac{2}{5}$

$\frac{7 \quad 0 \quad 0\frac{4}{5} \times 4}{5} = 5 \quad 12 \quad 0\frac{16}{25}$

Ans. $= 26$ 12 $3\frac{1}{25}$

(3)
£ s. d. £ s. d.
40 11 $6\frac{3}{8} \times 57 = 2312$ 17 $3\frac{3}{8}$
40 11 $6\frac{3}{8} \div 20 =$ 2 0 $6\frac{147}{160}$
Ans. 2314 17 $10\frac{47}{160}$

(4)
ro. po. yds. ac. ro. po. yds.
3 35 $27\frac{1}{2} \times 81 = 78$ 3 28 $19\frac{1}{4}$
3 35 $27\frac{1}{2} \div 2 =$ 1 37 $28\frac{7}{8}$
Ans. 79 1 26 $17\frac{7}{8}$

(5)
mi. fur. po. yds. mi. fur. po. yds.
4 3 37 $4\frac{1}{5} \times 5 = 22$ 3 28 $4\frac{1}{2}$
4 3 37 $4\frac{1}{5} \times \frac{5}{7} =$ 3 1 26 $5\frac{5}{14}$
Ans. 25 5 15 $4\frac{5}{14}$

(6)
tons. cwt. lbs. tons. cwt. lbs.
84 13 $3 \times 23 = 1946$ 19 69

$\frac{84 \quad 13 \quad 3 \times 5}{9} = 47 \quad 0 \quad 63\frac{8}{9}$

Ans. 1994 0 $20\frac{8}{9}$

(7)
£ s. d. £ s. d. £ s. d.
50 10 $7 \div \frac{1}{8} = 50$ 10 $7 \times 8 = 404$ 4 8

(8)
cwt. qrs. lbs.
597 2 8
3

$40 \begin{cases} 5 \\ 8 \end{cases}$ | 1792 2 24
| 358 2 $4\frac{4}{5}$

Ans. 44 3 $7\frac{3}{5}$

(9)
£ s. d.
9 9 $7\frac{5}{16}$
4

$15 \begin{cases} 5 \\ 3 \end{cases}$ | 37 18 $5\frac{1}{4}$
| 7 11 $8\frac{1}{4}$

Ans. 2 10 $6\frac{3}{4}$

(10) yrs. mo.
6491 8 .
11
4133) 71408 4 (17 yrs.
4133
30078
28931
1147
12
4133) 13768 (3 mo.
12399
1369
4
4133) 5476 (1 wk.
4133
1343
7
4133) 9401 (2 dys.
8266
1135
24
4540
2270
4133) 27240 (6 hrs.
24798
2442

Ans. 17 yrs. 3 mo. 1 wk. 2 dys. $6\frac{2442}{4133}$ hrs.

(11) Since $12\frac{10}{12} = 12\frac{5}{6} = \frac{77}{6}$.

£ s. d.
20 18 . $2\frac{167}{310}$
6
$77\left\{\begin{array}{l}11\\7\end{array}\right.$ | 125 9 $3\frac{6}{155}$
| 11 8 $1\frac{62}{1705}$
Ans. 1 12 $7\frac{626}{11935}$

(12) yds. qrs. na.
571 2 1
7
166) 4000 . 3 . 3 (24 yds.
332
680
664
16
4
67 qrs.
4
166) 271 (1 na.
166
105

Ans. 24 yds. $1\frac{105}{166}$ na.

Ex. XLV. (p. 127.)

(1) £ fl.
15 . 6
10
156 *fl.*
10
1560 *c.*
10
15600 *m.*

fl. c. m.
6 . 3 . 2
10
63·2 *c*
10
632 *m.*

(2) £ fl.
30 . 9·5
10
309·5 *fl.*
10
3095 *c.*
10
30950 *m.*

£ fl. c. m.
96 . 1 . 2 . 9
10
961·29 *fl.*
10
9612·9 *c.*
10
96129 *m.*

(3) £ fl. c.
18 . 0 . 6·5
10
180·65 *fl.*
10
1806·5 *c.*
10
18065 *m.*

fl.
9·25
10
92·5 *c.*
10
925 *m.*

(4)
$$\begin{array}{r} \text{£} \quad \text{fl.} \quad \text{c.} \quad \text{m.} \\ 10 \,.\, 0 \,.\, 0 \,.\, 1 \\ 10 \\ \hline 100{\cdot}01\,\text{fl.} \\ 10 \\ \hline 1000{\cdot}1\,\text{c.} \\ 10 \\ \hline 10001\,\text{m.} \end{array} \qquad \begin{array}{r} \text{£} \quad \text{fl.} \quad \text{c.} \\ 46 \,.\, 0 \,.\, 2{\cdot}5 \\ 10 \\ \hline 460{\cdot}25\,\text{fl.} \\ 10 \\ \hline 4602{\cdot}5\,\text{c.} \\ 10 \\ \hline 46025\,\text{m.} \end{array}$$

Ex. XLVI. (p. 129.)

1. (1)
$$\begin{array}{r} \text{£} \\ 76{\cdot}853 \\ 27{\cdot}909 \\ 84{\cdot}01 \\ 56{\cdot}362 \\ 19{\cdot}001 \\ \hline 264{\cdot}135 \end{array}$$
Ans. £264. 1*f.* 3*c.* 5*m.*

(2)
$$\begin{array}{r} \text{£} \\ 252{\cdot}25 \\ 300{\cdot}025 \\ {\cdot}45 \\ {\cdot}052 \\ \hline 552{\cdot}777 \end{array}$$
Ans. £552. 7*f.* 7*c.* 7*m.*

2. (1)
$$\begin{array}{r} \text{£} \\ 19{\cdot}5 \\ 16{\cdot}39 \\ \hline 3{\cdot}11 \end{array}$$
Ans. £3. 1*f.* 1*c.*

(2)
$$\begin{array}{r} \text{£} \\ 20{\cdot} \\ 19{\cdot}999 \\ \hline {\cdot}001 \end{array}$$
Ans. 1*m.*

(3)
$$\begin{array}{r} \text{£} \\ 5{\cdot}55 \\ 4{\cdot}045 \\ \hline 1{\cdot}505 \end{array}$$
Ans. £1. 5*f.* 5*m.*

3. (1)
$$\begin{array}{r} \text{£} \\ 76{\cdot}803 \\ 5 \\ \hline 384{\cdot}015 \end{array}$$
Ans. £384. 1*c.* 5*m.*

$$\begin{array}{r} \text{£} \\ 76{\cdot}803 \\ 63 \\ \hline 230409 \\ 460818 \\ \hline 4838{\cdot}589 \end{array}$$
Ans. £4838. 5*f.* 8*c.* 9*m.*

(3)
$$\begin{array}{r} \text{£} \\ 150{\cdot}005 \\ 2005 \\ \hline 750025 \\ 300010 \\ \hline 300760{\cdot}025 \end{array}$$
Ans. £300760. 2*c.* 5*m.*

(2)
$$\begin{array}{r} \text{£} \\ {\cdot}925 \\ 18 \\ \hline 7400 \\ 925 \\ \hline 16{\cdot}650 \end{array}$$
Ans. £16. 6*f.* 5*c.*

$$\begin{array}{r} \text{£} \\ {\cdot}925 \\ 1008 \\ \hline 7400 \\ 925 \\ \hline 932{\cdot}400 \end{array}$$
Ans. £932. 4*f.*

$$\begin{array}{r} \text{£} \\ 150{\cdot}005 \\ 18576 \\ \hline 900030 \\ 1050035 \\ 750025 \\ 1200040 \\ 150005 \\ \hline 2786492{\cdot}880 \end{array}$$
Ans. £2786492. 8*f.* 8*c.*

4. (1)
$$\begin{array}{r|l} & \text{£} \\ 5 & 194{\cdot}575 \\ \hline & 38{\cdot}915 \end{array}$$
Ans. £38. 9*f.* 1*c.* 5*m.*

(2)
$$\begin{array}{r|l} & \text{£} \\ 11 & 10764{\cdot}204 \\ \hline & 978{\cdot}564 \end{array}$$
Ans. £978. 5*f.* 6*c.* 4*m.*

(3)
$$\begin{array}{r}
\pounds \\
7380)\,342136\cdot8\,(46\cdot36 \\
\underline{29520} \\
46936 \\
\underline{44280} \\
26568 \\
\underline{22140} \\
44280 \\
\underline{44280}
\end{array}$$

Ans. £46. 3*f.* 6*c.*

Ex. XLVII. (p. 129.)

MISCELLANEOUS EXAMPLES.

I.

(1) $\overset{\text{hf-guin.}}{537983} = \overset{\text{s.}}{56488821\frac{1}{2}} = \overset{\text{seven sh. pieces.}}{806974\frac{1}{2}}$

and $\overset{\text{seven sh. pieces.}}{806974\frac{1}{2}} \times 21 = \overset{\text{groats.}}{16946464\frac{1}{2}}.$

(3)
$$\begin{array}{rrrl}
\pounds & s. & d. & \\
1 & 18 & 6\frac{1}{2} & \\
 & & 10 & \\
\hline
19 & 5 & 5 & \text{for } 10 \\
 & & 10 & \\
\hline
192 & 14 & 2 & \text{for } 100 \\
 & & 10 & \\
\hline
1927 & 1 & 8 & \text{for } 1000 \\
 & & 10 & \\
\hline
19270 & 16 & 8 & \text{for } 10000 \\
5781 & 5 & 0 & \text{for } 3000 \\
1348 & 19 & 2 & \text{for } 700 \\
96 & 7 & 1 & \text{for } 50 \\
\hline
\pounds26497 & 7 & 11 & \text{for } 13750.
\end{array}$$

(4) $\overset{\pounds}{26}\ \overset{s.}{14} = \overset{d.}{6408}$, and a noble $= \overset{d.}{80}$

$$\therefore \frac{6408}{80} = 80\tfrac{1}{10}.$$

(5)
$$\begin{array}{rrrl}
 & s. & d. & \\
 & 1 & 7\frac{1}{2} & = \text{profit on each yard} \\
 & & 10 & \\
\hline
 & 16 & 3 & \text{for 10 yards} \\
 & & 10 & \\
\hline
\pounds8 & 2 & 6 & \text{for } 100 \\
 & & 10 & \\
\hline
81 & 5 & 0 & \text{for } 1000 \\
56 & 17 & 6 & \text{for } 700 \\
4 & 17 & 6 & \text{for } 60 \\
 & 4 & 10\frac{1}{2} & \text{for } 3 \\
\hline
\pounds143 & 4 & 10\frac{1}{2} & \text{for } 1763.
\end{array}$$

(6)
$$\begin{array}{rl}
\pounds14 \times 52 = \overset{\pounds}{728} & \text{year's income,} \\
\pounds128.\ 10s. \times 4 = \underline{514} & \text{year's expenses,} \\
214 & \text{saving each year,} \\
\underline{8} & \\
\pounds1712 & \textit{Ans.}
\end{array}$$

(7) $\overset{s.}{21} + \overset{s.}{20} + \overset{s.}{10}\ .\ \overset{d.}{6} + \overset{s.}{5} + \overset{s.}{2}\ .\ \overset{d.}{6} = \overset{s.}{59}$

$\overset{\pounds}{398}\ .\ \overset{s.}{5} = \overset{s.}{7965};$

$$\therefore \textit{Ans.} = \frac{7965}{59} = 135.$$

(8) By selling £90 worth of the mixture at 10*s.* a gallon, I must have 180 gallons of it; and since there are 126 gallons in a pipe, I must add (180 — 126) gallons = 54 gallons of water.

II.

(1)

$$49\left\{\begin{array}{r}\\7\\7\\\\\end{array}\right.\begin{array}{|rcrcr}\multicolumn{1}{r}{\text{£}} & & \multicolumn{1}{r}{s.} & & \multicolumn{1}{r}{d.}\\ 1844 & . & 2 & . & 8\frac{1}{2}\\ \hline 263 & . & 8 & . & 11\frac{1}{2}\\ \hline \multicolumn{1}{r}{37} & . & 12 & . & 8\frac{1}{2}\end{array}$$

(2)

$$9\begin{array}{|rcrcr}\multicolumn{1}{r}{\text{£}} & & \multicolumn{1}{r}{s.} & & \multicolumn{1}{r}{d.}\\ 6734 & . & 5 & . & 9\\ \hline \multicolumn{1}{r}{748} & . & 5 & . & 1\\ \multicolumn{1}{r}{} & & & & 8\\ \hline \multicolumn{1}{r}{5986} & . & 0 & . & 8\end{array}\begin{array}{l}\\\\\text{value of furniture.}\\\\\text{value of house.}\end{array}$$

(3)

$$\begin{array}{r}1728\left\{\begin{array}{r}12\\12\\12\end{array}\right.\\27\left\{\begin{array}{r}3\\9\end{array}\right.\\\\\end{array}\begin{array}{|r}\multicolumn{1}{r}{\text{cub. in.}}\\ 4203239040\\ \hline 350269920\\ \hline 29189160\\ \hline 2432430\\ \hline 810810\\ \hline \multicolumn{1}{r}{90090}\end{array}\begin{array}{l}\\\\\\\\\text{cub. ft.}\\\\\text{cub. yds.}\end{array}$$

also 1 load = 2560 pints, and 2560 pints × 7000 = 17920000 grains.

(4)

$$5\begin{array}{|rcrcr}\multicolumn{1}{r}{\text{£}} & & \multicolumn{1}{r}{s.} & & \multicolumn{1}{r}{d.}\\ 3 & . & 13 & . & 9\\ \hline & & 14 & . & 9\end{array}$$

$$\begin{array}{lrcrcrcrcr} & s. & & d. & & \text{£} & & s. & & d.\\ \text{therefore} & 14 & . & 9\times 3 & = & 2 & . & 4 & . & 3\\ & 14 & . & 9\times 2 & = & 1 & . & 9 & . & 6\end{array}$$

(5) 834 guineas = £834 + £41. 14*s.* = £875. 14*s.*,

(1429 × 4½)*s.* = 6430½*s.* = £321. 10*s.* 6*d.*;

therefore, there remains £554. 3*s.* 6*d.*

(6) For every 2*s.* 2¾*d.* of tax there is £1 of property,

now £974. 16*s.* 3½*d.* = 935822*q.*,

and 2*s.* 2¾*d.* = 107*q.*,

and since $\frac{935822}{107} = 8746$;

therefore, property is worth £8746.

(7)

$$\overset{\text{pipes.}}{\tfrac{2}{3}\text{ of }2} = \overset{\text{galls.}}{\frac{4\times 126}{3}} = \overset{\text{galls.}}{4\times 42} = \overset{\text{quarts.}}{4\times 42\times 4} = \overset{\text{doz.}}{\frac{4\times 42\times 4}{12}} = \overset{\text{doz.}}{56},$$

$$\text{and } \overset{\text{pipes.}}{\tfrac{1}{3}\text{ of }2} = \overset{\text{galls.}}{2\times 42} = \overset{\text{pts.}}{2\times 42\times 8} = \overset{\text{doz.}}{\frac{2\times 42\times 8}{12}} = \overset{\text{doz.}}{7\times 8} = \overset{\text{doz.}}{56}.$$

(8)

$$\begin{array}{r@{\,}l} & \text{£}\ \ \ \textit{s.} \\ & 10\ .\ 8 \\ & \ \ \underline{20} \\ 52) & 208\ (4\textit{s.} \\ & \underline{208} \end{array}$$

$\therefore$ 4*s.* × 7 = 28*s.* *Ans.*

III.

(1)

$$\begin{array}{r|l} & \text{lbs. Av.} \\ & 56 \\ & \underline{7000} \\ 24\begin{cases}6\\4\end{cases} & \begin{array}{l}\underline{392000}-2 \\ \underline{65333}-1\end{array}\Big\}\ 8\text{ grs.} \\ 2,0 & \underline{1633,3}-13\text{ dwts.} \\ 12 & \underline{816} \\ & 68 \end{array}$$

Ans. 68 lbs. . 13 dwts. . 8 grs.

(2)

£1569. 17*s.* 4*d.* = 376768*d.*,

4*s.* 10*d.* = 58*d.*;

therefore, number of yards in each piece

$$= \frac{376768}{58 \times 56} = \frac{6496}{56} = \frac{928}{8} = 116.$$

(3)

		farthings.
1 half-sovereign	=	10 × 12 × 4 = 480
1 half-crown	=	30 × 4 = 120
1 sixpence	=	6 × 4 = 24
1 half-penny	=	1 × 2 = 2
		626
		5
	farthings	3130

(4) $6\frac{1}{2}$*d.* + $1\frac{1}{4}$*d.* = $7\frac{3}{4}$*d.* whole cost per lb.,

$7\frac{3}{4}$*d.* × 112 = £3. 12*s.* 4*d.* cost per cwt.;

$\therefore$ £4. 10*s.* − £3. 12*s.* 4*d.* = 17*s.* 8*d.* *Ans.*

(6) Reckoning 365 days in 1851, we find his expenses were £593. 2*s.* 6*d.*, and therefore his income was £593. 2*s.* 6*d.* + £294. 1*s.* 6*d.* = £887. 4*s.*

(7) If the first person has 1 share,

the second person must have 2 shares,

.. third .... 6 .....,

.. fourth .... 24 .....;

therefore, dividing the whole into (24 + 6 + 2 + 1) or 33 shares,

we have $\frac{198}{33} = \frac{66}{11} = 6$ guineas;

therefore, 6, 12, 36, 144, are the numbers.

(8)

$$\begin{array}{rl} \text{m.} & \\ 625 & = \text{railway fare} \\ 125 & = \text{cab fare} \\ 1350 & = \text{hotel bill} \\ \hline 2100 & = \text{expenses} \end{array}$$

$$\therefore\ 5791\,\text{m.} - 2100\,\text{m.} = 3691\,\text{m.} = £3.\ 6\,\text{f.}\ 9\,\text{c.}\ 1\,\text{m.}\ \textit{Ans.}$$

IV.

(2)

$$\begin{aligned} \text{Age of one} + \text{age of other} &= 51 \text{ years,} \\ \text{age of one} - \text{age of other} &= 23 \text{ years;} \\ \text{therefore, twice age of one} &= 74 \text{ years,} \\ \text{therefore, age of one} &= \frac{74}{2} \text{ years} = 37 \text{ years,} \\ \text{age of other} &= (51-37) \text{ years} = 14 \text{ years.} \end{aligned}$$

(3)

$$3s.\ 4\tfrac{1}{2}d. = 162q.;\quad 15s.\ 9\tfrac{3}{4}d. = 759q.$$

$$\therefore\ \textit{Ans.} = \frac{378 \times 759}{162} = 7 \times 253 = 1771.$$

(4)

$$\text{Value of each} = \frac{\overset{s.}{95} \times 20}{100} = \frac{\overset{s.}{95}}{5} = \overset{s.}{19}.$$

(5) 1.

$$\begin{array}{r} £ \quad \text{f.} \quad \text{c.} \quad \text{m.} \\ 27\ .\ 0\ .\ 3\ .\ 9 \\ 560\ .\ 2\ .\ 5\ .\ 0 \\ 30\ .\ 0\ .\ 3\ .\ 7 \\ \hline £617\ .\ 3\ .\ 2\ .\ 6 \end{array}$$

2.

$$16 \begin{cases} 4 \\ 4 \end{cases} \begin{array}{|r} £ \quad \text{f.} \quad \text{c.} \quad \text{m.} \\ 405\ .\ 5\ .\ 3\ .\ 6 \\ \hline 101\ .\ 3\ .\ 8\ .\ 4 \\ \hline £25\ .\ 3\ .\ 4\ .\ 6 \end{array}$$

(6)

$$\begin{aligned} £43.\ 9s.\ 4d. &= 10432d., \\ 5s.\ 4d. &= 64d. \end{aligned}$$

$$\therefore\ \frac{10432}{64} = 163 \text{ galls. bought.}$$

$$\begin{aligned} \text{Also } £54 &= 432 \text{ half-crowns,} \\ 7s.\ 6d. &= 3 \text{ half-crowns;} \end{aligned}$$

$$\therefore\ \frac{432}{3} = 144 \text{ galls. sold;}$$

$$\therefore\ 163 - 144 = 19 \text{ galls. leaked.}$$

(7)
$$\begin{array}{r}
\text{se.}\ \ \text{ro.}\\
24\ .\ 0\\
\underline{17\ .\ 3}\\
6\ .\ 1\\
\underline{4}\\
25\ \text{re.}\\
\underline{40\phantom{\ \text{re.}}}\\
1000\ \text{po.}
\end{array}$$

(8)
$$\begin{array}{r}
\text{days.}\ \ \text{hrs.}\ \ \ \text{hrs.}\\
365\ .\ 6 = 8766
\end{array}$$

$$\begin{array}{r}
8766\\
\underline{1851}\\
8766\\
43830\\
70128\\
\underline{8766}\\
16225866\ \text{hours.}
\end{array}$$

V.

(2) 25000 miles $= (25000 \times \overset{\text{barleycorns.}}{1760} \times 3 \times 12 \times 3) = 4752000000$ barleycorns.

(3) (3*s.* 7*d.*) × 12 = 43*s.* cost of one dozen,

£86. 10*s.* = 1730*s.*;

$\therefore \frac{1730}{43} = 40\frac{10}{43}$ dozen.

(4) (17*s.* 6*d.*) $\times 3549 = \frac{7}{8}$ £ $\times 3549 = \frac{24843}{8}$ £ = £3105. 7*s.* 6*d.* what he pays.

(5) Number of guineas $= \frac{16\frac{1}{4} \times 253}{21} = \frac{65 \times 253}{21 \times 4} = \frac{16445}{84} = 195\frac{65}{84}$.

(6) It makes $2\frac{1}{2}$ vibrations in one second;

therefore, in 24 hours it makes $24 \times 60 \times 60 \times 2\frac{1}{2} = 216000$ vibrations.

(7)
$$\begin{array}{r l}
 & \ \ \text{£}\quad\ \ s.\quad d.\\
247\,) & 619\ .\ 11\ .\ 2\ (\text{£}2\\
 & \underline{494}\\
 & 125\\
 & \underline{20}\\
247\,) & 2511\ (10s.\\
 & \underline{2470}\\
 & 41\\
 & \underline{12}\\
247\,) & 494\ (2d.\\
 & \underline{494}
\end{array}$$

therefore, £2. 10*s.* 2*d.* = price per gall. with duty,

$$\begin{array}{r}
\text{£}\quad s.\quad d.\\
8\ \underline{|\ 2\ .\ 10\ .\ 2}\\
6\ .\ 3\frac{1}{4}\ \text{duty per gall.}
\end{array}$$

(8)
$$\begin{array}{r}
\text{£}\quad \text{c.}\quad \text{m.}\qquad\qquad \text{£}\quad\ \text{f.}\quad \text{c.}\quad \text{m.}\\
(23\ .\ 4\ .\ 6) \times 12 = 276\ .\ 5\ .\ 5\ .\ 2\\
(18\ .\ 0\ .\ 1) \times \ \ 6 = \underline{108\ .\ 0\ .\ 0\ .\ 6}\\
\text{amount} = 384\ .\ 5\ .\ 5\ .\ 8
\end{array}$$

VI.

(1)

$$\begin{array}{rl}
 & \qquad\qquad\ \ \pounds \qquad\quad s. \quad d. \\
2793461) & 130524465\ .\ 4\ .\ 6\ (\pounds 46 \\
 & \underline{11173844} \\
 & \ \ 18786025 \\
 & \underline{\ \ 16760766} \\
 & \ \ \ \ 2025259 \\
 & \underline{\qquad\qquad\ \ 20} \\
2793461) & 40505184\ (14s. \\
 & \underline{\ 2793461} \\
 & 12570574 \\
 & \underline{11173844} \\
 & \ \ 1396730 \\
 & \underline{\qquad\qquad 12} \\
2793461) & 16760766\ (6d. \\
 & \underline{16760766}
\end{array}$$

Ans. £46. 14*s.* 6*d.*

(2) 1 mi. 467 yds. 1 ft. = 6682 ft., and $\frac{6682}{514} = 13$ ft. = 4 yds. 1 ft.

(3)

$$\begin{array}{rrrl}
\pounds & s. & d. & \\
0\ . & 16\ . & 4\frac{1}{2} & \\
 & & \underline{10} & \\
8\ . & 3\ . & 9 & \text{for } 10 \\
 & & \underline{10} & \\
81\ . & 17\ . & 6 & \text{for } 100 \\
 & & \underline{4} & \\
327\ . & 10\ . & 0 & \text{for } 400 \\
40\ . & 18\ . & 9 & \text{for } 50 \\
4\ . & 1\ . & 10\frac{1}{2} & \text{for } 5 \\
\hline
\pounds 372\ . & 10\ . & 7\frac{1}{2} & \text{for } 455
\end{array}$$

(4) Half a ton = 1120 lbs.;

$\therefore$ $(1120 \times 7\frac{1}{2})d. = (560 \times 15)d. = \pounds\frac{560 \times 15}{12 \times 20} = \pounds 35$;

$\therefore$ he gains $(35 - 30)\pounds = \pounds 5$.

(5)

$$\begin{array}{llrrrr}
\text{galls.} & & s. & \pounds & s. & d. \\
10 & \text{cost} & 10 \times 12 = & 6\ . & 0\ . & 0 \\
15 & \text{“} & 15 \times 14\frac{1}{2} = & 10\ . & 17\ . & 6 \\
\underline{18} & \text{“} & 18 \times 15\frac{3}{4} = & 14\ . & 3\ . & 6 \\
\cline{4-6}
43 & & & 31\ . & 1\ . & 0 \\
 & & & 2\ . & 5\ . & 6 \\
\cline{4-6}
 & & & 33\ . & 6\ . & 6
\end{array}$$

therefore, he must sell the mixture at the rate of

$$\frac{\pounds 33.\ 6s.\ 6d.}{43} = 15s.\ 6d. \text{ per gall.}$$

(6) By the question, 16 women's shares = 48 children's,

12 men's shares = 72 children's;

therefore, we may take the money to be divided among

(30 + 48 + 72) children = 150 children.

Now (£4. 15*s.*) ÷ 150 = $\frac{825}{150}$ *s.* = 5*s.* 6*d.* child's share;

∴ (5*s.* 6*d.*) × 3 = 16*s.* 6*d.* woman's share,

(5*s.* 6*d.*) × 6 = £1. 13*s.* 0*d.* man's share.

(7) 1 linear yard = $\frac{50}{11}$ links, 1 square yard = $\frac{50 \times 50}{11 \times 11}$ links,

1 acre = 4840 sq. yds. = $\left(\frac{50 \times 50}{11 \times 11} \times 4840\right)$ sq. links = 100000 sq. links.

(8) £2. 2*s.* + £1. 1*s.* + 14*s.* = £3. 17*s.* = 77*s.*, £1686. 5*s.* = 32725*s.*;

therefore, he will have $\frac{32725}{77} = \frac{4675}{11} = 425$ qrs. of each.

VII.

(1) 1852, 1856, 1860 being leap years,

number of days in the 10 years = (10 × 365 + 3) days = 3653 days;

∴ (3653 × 24 × 60) min. = (87672 × 60) min. = 5260320 minutes.

(2)

$$27\left\{\begin{array}{l}3\\9\end{array}\right.\begin{array}{|rcrcrcr}\text{tons.}&&\text{cwt.}&&\text{qrs.}&&\text{lbs.}\\ 425&.&15&.&2&.&12\\ \hline 141&.&18&.&2&.&4\\ \hline 15&.&15&.&1&.&16\end{array} \qquad 28\left\{\begin{array}{l}4\\7\end{array}\right.\begin{array}{|rcrcr}\text{mi.}&&\text{fur.}&&\text{po.}\\ 1361&.&4&.&28\\ \hline 340&.&3&.&7\\ \hline 48&.&5&.&1\end{array}$$

198 guineas = (198 × 21)*s.*, 1 moidore = 27*s.*;

therefore, number of moidores = $\frac{198 \times 21}{27} = 154$.

(3) 110 yards are contained 16 times in 1760 yards;

∴ 5 × 16 = 80 feet = $26\frac{2}{3}$ yards.

(4) Number of seconds = $\frac{20000000000000}{192000}$;

therefore, number of days = $\frac{20000000000}{192 \times 60 \times 60 \times 24} = \frac{200000000}{192 \times 6 \times 6 \times 24}$

$$= \frac{25000000}{192 \times 6 \times 6 \times 3} = \frac{6250000}{192 \times 27} = \frac{781250}{24 \times 27} = \frac{390625}{12 \times 27}$$

$$= \frac{390625}{324} = 1205\tfrac{205}{324}.$$

(5) (£100. 2*s.* 6*d.*)÷45=£2. 4*s.* 6*d.* share of each,
(£2. 4*s.* 6*d.*)×20=£44. 10*s.* share of 20,
£100. 2*s.* 6*d.*—£44. 10*s.*=£55. 12*s.* 6*d.* to be divided among 15;
∴ (£55. 12*s.* 6*d.*)÷15=£3. 14*s.* 2*d.* share of each.

(6)

guineas.	£	
12000=	12600	share of third son,
1500=	1575	
	14175	share of second son,
	5000	
	19175	share of eldest son;

and £19175+£14175+£12600=£45950 sum left by the father.

(7) (8*s.* 6*d.*)×128=£54. 8*s.* cost of wine,
£54. 8*s.*+£5. 12*s.*=£60 sum he must sell it for;
therefore, $\frac{60\times20}{5}=240$ the number of gallons he must have;
and therefore, 240—128=112 the number of gallons of water that must be added.

(8) 4 shillings in the pound is $\frac{1}{5}$ of a debt,
5 .... $\frac{1}{4}$ ....,
10 .... $\frac{1}{2}$ ....;
therefore, he receives for the bad debts,

	£	*s.*	*d.*		£	*s.*	*d.*
	360	7	6	÷5=	72	1	6
	120	13	0	÷4=	30	3	3
	21	4	0	÷2=	10	12	0
he receives in all		.	.		112	16	9
his good debts are		.	.		456	18	3
his assets .	.	.	.		569	15	0

£4558÷£569. 15*s.* gives 8 as a quotient;
therefore he pays $\frac{1}{8}$ of his debts, or 2*s.* 6*d.* in the £.

VIII.

		ton.	cwt.	qr.	lbs.	oz.	drs.
315	9	1	3	1			
	7		2	2	9	5	$5\frac{1}{3}$
	5			1	13	5	$5\frac{1}{3}$
Ans.					8	4	$4\frac{4}{15}$

(3) $$\overset{s.\ \ d.}{(25\,.\,6)}\times 98=\overset{s.}{\frac{51\times 98}{2}}=\overset{\text{guineas.}}{\frac{51\times 49}{21}}=\overset{\text{guineas.}}{119}\text{ value of brandy;}$$

therefore, $\overset{\text{guineas.}}{119}-39=\overset{\text{guineas.}}{80}$ value of the cloth;

therefore $\frac{80\times 21\times 12}{576}d.=\frac{80\times 21}{48}d.=35d.=2s.\ 11d.$ per yard.

(4)
$$\begin{array}{rl}
\overset{s.}{7000} & \text{per hour} \\
9 & \\ \hline
63000 & \text{per day} \\
67 & \\ \hline
441000 & \\
378000 & \\ \hline
2,0\,|\,422100,0 & \\ \hline
£211050 & \text{in 67 days.}
\end{array}$$

(5) In 1852 there were 366 days.

Now $(£2.\ 0s.\ 1\tfrac{1}{2}d.)\times 366=£734.\ 5s.\ 9d.$;

$\therefore$ £734. 5*s*. 9*d*. + £50 = £784. 5*s*. 9*d*. his income.

(6) 1.
$$\begin{array}{rcccccc}
£ & & \text{f.} & & \text{c.} & & \text{m.} \\
896 & . & 5 & . & 4 & . & 7 \\
391 & . & 5 & . & 3 & . & 8 \\
23 & . & 0 & . & 9 & . & 6 \\ \hline
£1311 & . & 1 & . & 8 & . & 1
\end{array}$$

2.
$$\begin{array}{rcccccc}
£ & & \text{f.} & & \text{c.} & & \text{m.} \\
896 & . & 5 & . & 4 & . & 7 \\
391 & . & 5 & . & 3 & . & 8 \\ \hline
£505 & . & 0 & . & 0 & . & 9
\end{array}$$

3.
$$\begin{array}{r}
\text{mils.} \\
23096 \\
248 \\ \hline
184768 \\
92384 \\
46192 \\ \hline
5727808
\end{array}
=\begin{array}{rcccccc}
£ & & \text{f.} & & \text{c.} & & \text{m.} \\
5727 & . & 8 & . & 0 & . & 8
\end{array}$$

(7)
$$\begin{array}{rcrcrcll}
 & & £ & & s. & & d. & \\
(£11.\ 11s.)\times 175 & = & 2021 & . & 5 & . & 0 & \text{value of oxen} \\
(£1.\ 11s.\ 6d.)\times 2003 & = & 3154 & . & 14 & . & 6 & \text{value of sheep} \\
(10s.\ 6d.)\times 563 & = & 295 & . & 11 & . & 6 & \text{value of pigs} \\
9d.\times 87 & = & 3 & . & 5 & . & 3 & \text{value of fowls} \\ \hline
 & 5\,| & 5474 & . & 16 & . & 3 & \\ \hline
\textit{Ans.} & & £1094 & . & 19 & . & 3 & \text{share of each.}
\end{array}$$

(8) $\frac{4}{5}$ of £90 = £72 sum the house is rated at. Now upon each £ I pay in the course of the year

$$(9+10+14+8+19)d.=60d.;$$

$$\therefore\ (72\times 60)d.=(6\times 60)s.=£18\text{ amount of rates;}$$

$$\therefore\ £90+£18=£108\text{ whole cost of house.}$$

IX.

(1) In the year 1851 he had lived 171 days. Now between Jan. 1, 1770, and June 1, 1851, he had lived, since 1800 was not a leap year,

$$(365 \times 62 + 366 \times 19 + 171) \text{ days} = 29755 \text{ days.}$$

$$\text{Now } (30000-29755) \text{ days} = 245 \text{ days,}$$

and reckoning back from Jan. 1, 1770, we find that the day required was May 1, 1769.

(2) 100 miles $= (100 \times 1760 \times 3)$ feet $= 528000$ feet;

$$\therefore \frac{528000}{10} = 52800 \text{ revolutions of fore-wheel,}$$

$$\frac{528000}{16} = 33000 \text{ revolutions of hind-wheel.}$$

Ans. $\overline{19800}$

(3)

```
 tons. cwt. qrs. lb.
   4 .  0 .  3 . 1 weight of loaded truck
   1 . 10 .  0 . 0 ............ truck
   2 . 10 .  3 . 1 ............ packages
  20
  50
   4
 203
  28
1625
 406
      758) 5685 (7 lbs.
           5306
            379
             16
      758) 6064 (8 oz.
           6064
```

Ans. 7 lbs. 8 oz. each.

(4) (£15. 15*s.*) × 35 = (£78. 15*s.*) × 7 = £551. 5*s.* worth of *A*'s ponies,

(£24. 15*s.*) × 24 = £99 × 6 = £594 value of *B*'s horses;

∴ £594 — £551. 5*s.* = £42. 15*s.* what *A* should give *B.*

(5) $4\frac{1}{2}$ miles $= (4\frac{1}{2} \times 1760 \times 3)$ feet $= 23760$ feet,

```
1142) 23760 (20
      2284
       920
```

$\therefore 20\frac{920}{1142} = 20\frac{460}{571}$ number of seconds required.

(6) Since $1+2+3+4+5+6+7+8+9+10+11+12=78$,

$\therefore\ 2\times 78=156$ strikes in 24 hours;

also $(1+2+3+4)\times 24=10\times 24=240$ chimes in 24 hours;

$\therefore\ (156+240)\times 365=396\times 365=144540$ times in all.

(7) 16 mi. $=(16\times 1760\times 3)$ ft. $=84480$ ft.,

$(110\times 2\frac{1}{2})$ ft. $=\frac{550}{2}$ ft. $=275$ ft. he walks per minute,

$$\text{also } \frac{84480}{275}=\frac{16896}{55}=\frac{1536}{5}=307\tfrac{1}{5};$$

therefore, he takes $307\frac{1}{5}$ minutes, or 5 hrs. 7 m. 12 sec. to walk the distance.

(8) The men work 55 hours in the week,

the boys ...... 77........................;

$\therefore\ (55\times 6)d.=330d.=$ wages received by each man weekly,

$(330\times 60)d.=19800d.=$ wages of all the men weekly,

also $(77\times 2\times 45)d.=6930d.=$ wages of the boys weekly;

$\therefore\ (19800+6930)d.=26730d.$ total of weekly wages;

$$\therefore\ \frac{26730\times 52}{12}s.=(8910\times 13)s.=115830s.=£5791.\ 10s. \text{ annual wages.}$$

X.

(1) 146 miles $=(146\times 1760)$ yards;

$$\text{therefore, expense}=£\,\frac{146\times 1760\times 3\times 21}{20}=£(146\times 88\times 3\times 21)$$

$=£(12848\times 63)=£809424.$

(2) $£52\times 18=$ £936 his personal expenses,

£936 + £150 = £1086 his yearly expenditure,

£2100 — £1086 = £1014 his annual saving,

£1014 × 8 = £8112 his savings in 8 years.

(3) 12 lbs. 8 oz. = 200 oz.,

and 8 oz. are contained 25 times in 200 oz.;

$\therefore\ (25\times 12)d.=25s.=£1.\ 5s.$ is the value required.

(4) The number of yards in the packages will be

$$7\times7\times27\times81,$$

and dividing these into parcels of 3 yards each, we shall have

$$(7\times7\times27\times27) \text{ parcels, each worth } 1\tfrac{1}{2} \text{ guineas;}$$

$$\text{therefore, value required} = \frac{\overset{\text{guineas.}}{7\times7\times27\times27\times3}}{2} = \frac{\overset{\text{guineas.}}{107163}}{2}$$

$$= £\frac{107163\times21}{2\times20} = £\frac{2250423}{2\times20} = £56260.\ 11s.\ 6d.$$

(5)

$$\begin{array}{rl} \overset{\text{mils.}}{625}\times\ 6 = \overset{\text{mils.}}{3750} & \text{cost of 1st ingredients,} \\ 900\times\ 4 = 3600 & \text{cost of 2nd ingredients,} \\ 1115\times10 = 11150 & \text{cost of 3rd ingredients,} \\ \text{number of gallons} = 2,0\ \underline{\big)\ 1850,0} & \text{cost of mixture} \\ 925 & \end{array}$$

∴ 9 f. 2 c. 5 m. is the price per gallon.

(6) Since each counts 100 sovereigns per minute, 5000 persons count 500000 per minute,

$$\text{also } \frac{1000000000000}{500000} = 2000000;$$

therefore, it will take them 2000000 minutes to count a billion sovereigns. Again, the number of days will be

$$\frac{2000000}{60\times24} = \frac{50000}{6\times6} = \frac{12500}{9} = 1388\tfrac{8}{9} \text{ days.}$$

Now in 3 years, from the time they commence counting, there will be

$$366+365+365=1096 \text{ days,}$$

so they have $293\frac{8}{9}$ days in 1855, and 293 days will just bring them to the 20th of October.

(7)

	£	s.	d.
Bank note =	20 .	0 .	0
note of hand =	6 .	10 .	0
13 farthings =	0 .	0 .	$3\frac{1}{4}$
45 halfpence =	0 .	1 .	$10\frac{1}{2}$
36 threepences =	0 .	9 .	0
58 groats =	0 .	19 .	4
96 sixpences =	2 .	8 .	0
67 shillings =	3 .	7 .	0
97 half-crowns =	12 .	2 .	6
126 crowns =	31 .	10 .	0
65 half-guineas =	34 .	2 .	6
77 guineas =	80 .	17 .	0
34 moidores =	45 .	18 .	0
Ans.	£238 .	5 .	$5\frac{3}{4}$

(8)

	s.	d.		£	s.	d.
5 foremen at	4	6	per day =	1	2	6
63 workmen at	2	9	.... =	8	13	3
75 boys at	1	8	.... =	6	5	0
47 girls at	1	4½	.... =	3	4	7½
			wages of all daily =	19	5	4½
						6
			weekly wages =	115	12	3

and yearly wages = £115. 12*s*. 3*d*. × 52 = £6011. 17*s*.

XI.

(1) The first has £568. 14*s*. 4*d*. + £728. 18*s*. 2*d*., or £1297. 12*s*. 6*d*. more than the third, and the second has £728. 18*s*. 2*d*. more than the third. Taking away these sums from the whole amount we have £4816. 3*s*. 9*d*. left, and the third part of this is £1605. 7*s*. 11*d*.;

	£	s.	d.		£	s.	d.		£	s.	d.
∴ share of third =	1605	7	11								
share of second =	1605	7	11	+	728	18	2	=	2334	6	1
share of first =	1605	7	11	+	1297	12	6	=	2903	0	5

(2)
£ s. £ s.
(152 . 10) × 52 = 7930 . 0 his annual expenditure,
(7522 . 10) ÷ 15 = 501 . 10 his annual saving,
364) 8431 . 10 (£23
728
1151
1092
59
20
364) 1190 (3*s*.
1092
98
12
364) 1176 (3*d*.
1092
84

Ans. £23. 3*s*. 3$\frac{3}{13}$*d*.

(3)

$$\begin{array}{r}
\text{cwt. qrs. lbs. oz.}\\
3\ .\ 2\ .\ 27\ .\ 15\\
\underline{4}\\
14\\
\underline{28}\\
139\\
\underline{28}\\
419\\
\underline{16}\\
2529\\
\underline{419}\\
6719
\end{array}
\qquad\qquad
\begin{array}{r}
\text{tons. cwt. qrs. lbs. oz.}\\
4\ .\ 13\ .\ 2\ .\ 27\ .\ 7\\
\underline{20}\\
93\\
\underline{4}\\
374\\
\underline{28}\\
3019\\
\underline{748}\\
10499\\
\underline{16}\\
63001\\
\underline{10499}\\
6719\big)\,167991\ (25\\
\underline{13438}\\
33611\\
\underline{33595}\\
16
\end{array}$$

(4) £16. 4*s.* × 4 = £64. 16*s.* whole cost.

Also there were (6 × 27) yds. in each bale;

therefore, cost of each yard $= \dfrac{\pounds 16.\ 4s.}{6 \times 27} = \dfrac{324}{162}\,s. = 2s.$

(5) Yearly toll from persons $= 5000 \times 365 = \overset{\text{halfpence.}}{1825000} = 912500d.$ (5000 × 365 under "halfpence.")

yearly toll from carriages $= (1500 \times 2 \times 365)d. = (3000 \times 365)d. = 1095000d.$

therefore, annual amount $= 1095000d. + 912500d. = 2007500d.$

$$\begin{array}{r|l}
\text{and}\ \ 12 & 2007500\\ \hline
2{,}0 & \ \ 16729{,}1\text{—}8\\ \hline
\textit{Ans.}\quad & \ \ \pounds 8364.\ 11s.\ 8d.
\end{array}$$

(6) $31 + 28 + \overset{\text{days.}}{31} + 30 + 31 + 30 = \overset{\text{days.}}{181}$

and

$$\begin{array}{r}
\pounds\\
181\big)\,210\ (\pounds 1\\
\underline{181}\\
29\\
\underline{20}\\
181\big)\,580\ (3s.\\
\underline{543}\\
37\\
\underline{12}\\
181\big)\,444\ (2d.\\
\underline{362}\\
82\\
\underline{4}\\
181\big)\,328\ (1q.\\
\underline{181}\\
147
\end{array}$$

Therefore *Ans.* = £1. 3*s.* $2\tfrac{1}{4}d.$ $\tfrac{147}{181}q.$

(7) 7*s*. 10½*d*. per stone = 15*s*. 9*d*. per quarter;

therefore (15*s*. 9*d*.) × 23 = £18. 2*s*. 3*d*. for the sugar.

Again, £18. 2*s*. 3*d*. = 17388*q*.,

and 4*s*. 5¾*d*. = 215*q*.,

and

$$\begin{array}{r l}
215\,)\,17388 & (80 \text{ lbs.} \\
1720 & \\
\hline
188 & \\
16 & \\
\hline
215\,)\,3008 & (13 \text{ oz.} \\
215 & \\
\hline
858 & \\
645 & \\
\hline
213 &
\end{array}$$

Therefore *Ans*. = 80 lbs. $13\frac{213}{215}$ oz. of tea.

(8)

	£	*s*.	*d*.
Cash =	500	0	0
5 bills (£48. 10*s*. 6*d*. each) =	242	12	6
the property =	742	12	6

	£	*s*.	*d*.
Burial cost	20	0	0
debts	164	0	0
	184	0	0

therefore £742. 12*s*. 6*d*. − £184 = £558. 12*s*. 6*d*. remaining property,

£558. 12*s*. 6*d*. ÷ 3 = £186. 4*s*. 2*d*. for eldest son,

£558. 12*s*. 6*d*. − £186. 4*s*. 2*d*. = £372. 8*s*. 4*d*. to be divided among the other sons;

therefore £372. 8*s*. 4*d*. ÷ 4 = £93. 2*s*. 1*d*. each.

XII.

(1) 2 oz. 16 dwts. = 56 dwts. 100 oz. 16 dwts. = 2016 dwts.

therefore number of spoons $= \frac{2016}{56} = \frac{252}{7} = 36$.

(2)

	£	*s*.	
	1227	15	yield of estate for 5 years,
135 guin. =	141	15	what he lays by,
	£1086	0	what he may spend in 5 years.

Now 1848 was a leap year, therefore, in the 5 years there were,

$$365 + 366 + \overset{\text{days.}}{365} + 365 + 365 = \overset{\text{days.}}{1826},$$

and $\frac{1086}{1826}$ £ $= \frac{543}{913}$ £ = 11*s*. 10½*d*. $\frac{870}{913}$*q*. what he may spend daily.

(3) $$19 \text{ years} = (19 \times 365\tfrac{1}{4}) \text{ days} = \frac{19 \times 365\frac{1}{4}}{29\frac{1}{2}} \text{ lunar months}$$

$$= \frac{19 \times 1461}{59} = \frac{27759}{59 \times 2} = 235\tfrac{29}{118}.$$

(4) $$1 \text{ talent} = 219000 \text{ grs.} = \frac{219000}{24 \times 20} \text{ oz.};$$

therefore value of a talent $= \dfrac{219000 \times 5 \times 12}{24 \times 20} d.$

$= 27375d. = 2281s.\ 3d. = £114.\ 1s.\ 3d.$

(5)

```
  £    s.   d.    d.
 14 .  3 .  6 = 3402
 17 .  3 .  5 = 4121

3402) 4121 (1·2113
      3402
      ----
       7190
       6804
       ----
        3860
        3402
        ----
         4580
         3402
         -----
         11780
         11206
         -----
           574
```

(6) $(5s.\ 3\tfrac{1}{2}d.) \times 56 = (£2.\ 2s.\ 4d.) \times 7 = £14.\ 16s.\ 4d.,$

also $£55.\ 12s. + £3.\ 11s. = £59.\ 3s.;$

$\therefore\ £59.\ 3s. - £14.\ 16s.\ 4d. = £44.\ 6s.\ 8d.,$

the price for which he has to sell the remainder.

Now he had (7×27) yds. = 189 yds. at first; therefore, he has $(189 - 56)$ yds. = 133 yds. to sell, the price of each yard will then be

$$£44\tfrac{1}{3} \div 133 = £\frac{133}{3} \div 133 = £\tfrac{1}{3} = 6s.\ 8d.$$

(7) 18 times the number of men = number of pence the men earned,
20 times the number of men = number of pence the women earned,
24 times the number of men = number of pence the boys earned,
$\therefore$ 62 times the number of men = number of pence earned by all;

also $(£7.\ 15s.) \div 5 = £1.\ 11s. = (31 \times 12)d.,$

therefore, number of men $= \dfrac{31 \times 12}{62} = \dfrac{12}{2} = 6;$

therefore, number of women $= 6 \times 2 = 12,$

and number of boys $= 6 \times 3 = 18.$

(8) For every £ he pays 6*s.* 8¼*d.* = 321*q.*;

therefore, he pays in all 2963 × 321*q.*

$$\begin{array}{r|r}
 & 2963 \\
 & 321 \\ \cline{2-2}
 & 2963 \\
 & 5926 \\
 & 8889 \\ \cline{2-2}
4 & 951123 - 3q. \\ \cline{2-2}
12 & 237780 - 0d. \\ \cline{2-2}
2{,}0 & 1981{,}5 \\ \cline{2-2}
\textit{Ans.} & \text{£}990.\ 15s.\ 0\tfrac{3}{4}d.
\end{array}$$

REDUCTION OF FRACTIONS.

Ex. XLVIII. (p. 140.)

(1) 1. $\frac{3}{8}$ of £1 $= \left(\frac{3 \times 20}{8}\right)s. = \frac{15}{2}s. = 7s.\ 6d.$;

$\frac{2}{3}$ of £1 $= \left(\frac{2 \times 20}{3}\right)s. = \frac{40}{3}s. = 13s.\ 4d.$;

$\frac{5}{8}$ of £1 $= \left(\frac{5 \times 20}{8}\right)s. = \frac{25}{2}s. = 12s.\ 6d.$;

$\frac{3}{4}$ of a guinea $= \left(\frac{3 \times 21}{4}\right)s. = \frac{63}{4}s. = 15s.\ 9d.$;

$\frac{5}{6}$ of a guinea $= \left(\frac{5 \times 21}{6}\right)s. = \frac{35}{2}s. = 17s.\ 6d.$

2. $\frac{3}{4}$ of £1. 10*s.* $= \left(\frac{3 \times 30}{4}\right)s. = \frac{45}{2}s. =$ £1. 2*s.* 6*d.*;

$\frac{2}{3}$ of £2 $= \left(\frac{2 \times 40}{3}\right)s. = \frac{80}{3}s. =$ £1. 6*s.* 8*d.*;

$\frac{3}{8}$ of 2*s.* 6*d.* $= \left(\frac{3 \times 30}{8}\right)d. = \frac{45}{4}d. = 11\frac{1}{4}d.$;

$\frac{3}{5}$ of 13*s.* 4*d.* $= \left(\frac{3 \times 160}{5}\right)d. = (3 \times 32)d. = 8s.$

3. $\frac{13}{240}$ of £1 $= \left(\frac{13 \times 240}{240}\right)d. = 13d. = 1s.\ 1d.$;

$\frac{5}{16}$ of 1*s.* $= \left(\frac{5 \times 12}{16}\right)d. = \frac{15}{4}d. = 3\frac{3}{4}d.$;

$$\tfrac{3}{5} \text{ of } 6s.\ 8d. = \left(\frac{3\times 80}{5}\right)d. = (3\times 16)d. = 4s.;$$

$$\tfrac{2}{9} \text{ of } 1s.\ 6d. = \left(\frac{2\times 18}{9}\right)d. = (2\times 2)d. = 4d.;$$

$$\tfrac{3}{7} \text{ of } 3s.\ 6d. = \left(\frac{3\times 42}{7}\right)d. = (3\times 6)d. = 1s.\ 6d.$$

4. $$2\tfrac{3}{7} \text{ of } 7s.\ 6d. = \frac{17\times 90}{7}d. = \frac{1530}{7}d. = 18s.\ 2\tfrac{1}{2}d.\ \tfrac{2}{7}q.;$$

$$\tfrac{5}{7} \text{ of } £2.\ 3s.\ 9d. = \frac{£10.\ 18s.\ 9d.}{7} = £1.\ 11s.\ 3d.;$$

$$\tfrac{8}{21} \text{ of a moidore} = \left(\frac{8\times 27}{21}\right)s. = \frac{72}{7}s. = 10s.\ 3\tfrac{1}{4}d.\ \tfrac{5}{7}q.;$$

$$\tfrac{2}{3} \text{ of } £135.\ 16s.\ 10\tfrac{1}{2}d. = \frac{£271.\ 13s.\ 9d.}{3} = £90.\ 11s.\ 3d.$$

5. $$\tfrac{2}{5} \text{ of } 4s.\ 7d. = \left(\frac{2\times 55}{5}\right)d. = (2\times 11)d. = 1s.\ 10d.;$$

$$1\tfrac{3}{5} \text{ of } £1.\ 2s.\ 9d. = \tfrac{8}{5} \text{ of } £1.\ 2s.\ 9d. = \frac{£9.\ 2s.}{5} = £1.\ 16s.\ 4\tfrac{3}{4}d.\ \tfrac{1}{5}q.;$$

$$\tfrac{5}{14} \text{ of } \tfrac{11}{18} \text{ of } 21s. = \left(\frac{5\times 11\times 21}{14\times 18}\right)s. = \frac{55}{12}s. = 4s.\ 7d.;$$

$$\tfrac{1}{3} \text{ of } \tfrac{3}{5} \text{ of } 9s.\ 10\tfrac{1}{2}d. = \tfrac{1}{5} \text{ of } 9s.\ 10\tfrac{1}{2}d. = 1s.\ 11\tfrac{1}{2}d.\ \tfrac{4}{5}q.$$

6. $$3\tfrac{1}{12} \text{ of } 2s.\ 6d. = 7s.\ 6d. + \tfrac{30}{12}d. = 7s.\ 6d. + 2\tfrac{1}{2}d. = 7s.\ 8\tfrac{1}{2}d.;$$

$$\tfrac{9}{11} \text{ of } £4.\ 14s.\ 5d. = \frac{£42.\ 9s.\ 9d.}{11} = £3.\ 17s.\ 3d.;$$

$$\tfrac{2}{3} \text{ of } \tfrac{4}{21} \text{ of } 10s.\ 6d. = \left(\frac{2\times 4\times 21}{3\times 21}\right)\text{sixpences} = \left(\frac{2\times 4\times 6}{3}\right)d. = 1s.\ 4d.;$$

$$\tfrac{1}{50} \text{ of } 100 \text{ guineas} = 2 \text{ guineas} = £2.\ 2s.$$

7. $$\tfrac{3}{5} \text{ of } \tfrac{7}{9} \text{ of } \tfrac{20}{21} \text{ of } 5 \text{ guineas} = \frac{3\times 7\times 20\times 5\times 21}{5\times 9\times 21}s. = \frac{140}{3}s. = £2.\ 6s.\ 8d.;$$

$$\tfrac{2}{9} \text{ of } £16.\ 16s.\ 3\tfrac{1}{4}d. = \frac{£33.\ 12s.\ 6\tfrac{1}{2}d.}{9} = £3.\ 14s.\ 8\tfrac{1}{2}d.\ \tfrac{8}{9}q.;$$

$$\tfrac{1}{1000} \text{ of } £441.\ 12s.\ 6d. = \frac{£44.\ 3s.\ 3d.}{100} = \frac{£4.\ 8s.\ 3\tfrac{3}{4}d.\ \tfrac{3}{5}q.}{10} = 8s.\ 9\tfrac{3}{4}d.\ \tfrac{24}{25}q.$$

8. $\frac{5}{16}$ of a cwt. $=\frac{5\times 112}{16}$ lbs. $=(5\times 7)$ lbs. $=35$ lbs. $=1$ qr. 7 lbs.;

$\frac{3}{4}$ of a lb. Avoird. $=\frac{3\times 16}{4}$ oz. $=12$ oz.;

$\frac{4}{5}$ of a mile $=\frac{4\times 8}{5}$ fur. $=6\frac{2}{5}$ fur. $=6$ fur. 88 yds.;

$\frac{5}{8}$ of an acre $=\frac{5\times 4}{8}$ ro. $=\frac{5}{2}$ ro. $=2$ ro. 20 po.

9. $\frac{5}{11}$ of a mile $=\frac{5\times 1760}{11}$ yds. $=800$ yds. $=3$ fur. 25 po. $2\frac{1}{2}$ yds.;

$\frac{3}{10}$ of a day $=\frac{3\times 24}{10}$ hrs. $=7\frac{1}{5}$ hrs. $=7$ hrs. 12 m.;

$\frac{2}{3}$ of a yard $=\frac{2\times 3}{3}$ ft. $=2$ ft.;

$\frac{2}{7}$ of 3 cwt. 1 qr. 14 lbs. $=\frac{6 \text{ cwt. } 3 \text{ qrs.}}{7}=3$ qrs. 24 lbs.

10. $7\frac{3}{5}$ lbs. Avoird. $=7$ lbs. $+\left(\frac{3\times 16}{5}\right)$ oz. $=7$ lbs. $9\frac{3}{5}$ oz.

$=7$ lbs. 9 oz. $9\frac{3}{5}$ drs.;

$1\frac{3}{4}$ lb. Troy $=1$ lb. $+\left(\frac{3\times 12}{4}\right)$ oz. $=1$ lb. 9 oz.;

$2\frac{2}{5}$ of a gallon $=2$ gall. $+\frac{2\times 8}{5}$ pts. $=2$ gall. $3\frac{1}{5}$ pts.

$=2$ gall. 1 qt. $1\frac{1}{5}$ pt.;

$4\frac{5}{19}$ of an acre $=4$ ac. $+\frac{20}{19}$ ro. $=4$ ac. 1 ro. 2 po. 3 yds. 1 ft. $94\frac{14}{19}$ in.

11. $3\frac{5}{12}$ of a hhd. of beer $=3$ hhd. $+\frac{5\times 54}{12}$ gall.

$=3$ hhd. $+\frac{45}{2}$ gall. $=3$ hhd. 22 gall. 2 qts.;

$2\frac{3}{8}$ of a tun of wine $=2$ tuns $+\frac{6}{8}$ pipe $=2$ tun $1\frac{1}{2}$ hhd.

$=2$ tuns 1 hhd. 31 gall. 2 qts.;

$6\frac{26}{29}$ bus. $=6$ bus. $+\frac{26\times 4}{29}$ pks.

$=6$ bus. $\frac{104}{29}$ pks. $=6$ bus. 3 pks. $1\frac{5}{29}$ gall.

12. $2\frac{1}{6}$ of a load $= 2$ ld. $+ 1$ c. $2\frac{2}{3}$ bus. $= 2$ ld. 1 c. 2 bus. 2 pks. $10\frac{2}{3}$ pts.;

$3\frac{109}{570}$ cub. yd. $= 3$ c. yd. $+ \frac{109 \times 27}{570}$ ft. $= 3$ c. yd. $+ \left(\frac{981}{190}\right)$ft.

$= 3$ yds. 5 ft. $281\frac{89}{95}$ in.;

$9\frac{5}{12}$ guineas $= £9\ 9s. + (\frac{5}{12} \times 21 \times 12)d. = £9\ 9s + 105d. = £9\ 17s.\ 9d.$

13. $\frac{7}{8}$ of $\frac{3}{5}$ of $10\frac{2}{3}$ hrs. $= \left(\frac{7 \times 3 \times 32}{8 \times 5 \times 3}\right)$ hrs. $= \frac{28}{5}$ hrs. $= 5$ hrs. 36 min.;

$£\,\dfrac{15\frac{3}{5}}{7\frac{4}{5}} = £\,\dfrac{\frac{78}{5}}{\frac{39}{5}} = £\frac{78}{39} = £2$;

$\dfrac{7\frac{1}{8}}{8\frac{1}{7}}$ of $\dfrac{5\frac{1}{7}}{7\frac{1}{5}}$ of $27s. = \left(\frac{57}{8} \times \frac{7}{57} \times \frac{36}{7} \times \frac{5}{36} \times 27\right)s.$

$= \left(\frac{5 \times 27}{8}\right)s. = 16s.\ 10\frac{1}{2}d.$

14. $\dfrac{\frac{4}{49}}{\frac{5}{14} \text{ of } 1\frac{1}{3}}$ of $£16\ 8s.\ 1\frac{1}{2}d. = \frac{4}{49} \times \frac{14}{5} \times \frac{3}{4}$ of $£16\ 8s.\ 1\frac{1}{2}d.$

$= \frac{2 \times 3}{7 \times 5}$ of $£16\ 8s.\ 1\frac{1}{2}d. = \dfrac{£98\ 8s.\ 9d.}{7 \times 5} = \dfrac{£14\ 1s.\ 3d.}{5} = £2\ 16s.\ 3d.$;

$\frac{3}{7}$ of $1\frac{2}{5}$ of $12\frac{1}{2}$ of $\frac{3}{44}$ of $£2 \times \frac{3}{44} = £\,\dfrac{3 \times 7 \times 25 \times 3 \times 2 \times 3}{7 \times 5 \times 2 \times 44 \times 44} = £\,\dfrac{27 \times 5}{44 \times 44}$

$= \dfrac{27 \times 5 \times 20 \times 12}{44 \times 44}d. = \dfrac{27 \times 5 \times 5 \times 3}{11 \times 11}d.$

$= \dfrac{2025}{11 \times 11}d. = \dfrac{184\frac{1}{11}d.}{11} = 1s.\ 4\frac{1}{2}d.\ \frac{114}{121}q.$

15. $\frac{5}{7}$ of $£1 \times 5\frac{3}{5} = £\,\dfrac{5 \times 28}{7 \times 5} = £4$;

$\frac{3}{8}$ of $\frac{2}{9}$ of $£1 \div \frac{1}{4} = £\,\dfrac{3 \times 2 \times 4}{8 \times 9} = £\frac{1}{3} = 6s.\ 8d.$

16. $19\frac{3}{4}$ of $£5\ 1s.\ 1\frac{1}{4}d.\ \frac{45}{79}q. = \frac{79}{4}$ of $4853\frac{45}{79}$ farthings

$= \frac{79}{4}$ of $\frac{383432}{79}$ farthings $= 95858q. = £99\ 17s.\ 0\frac{1}{2}d.$;

$2\frac{2}{5}$ of $£8\ 14s.\ 2\frac{7}{12}d. \div 8\frac{4}{5} = \frac{12}{5}$ of $£8\ 14s.\ 2\frac{7}{12}d. \times \frac{5}{44}$

$= \dfrac{£104\ 10s.\ 7d.}{44} = \dfrac{£9\ 10s.\ 0\frac{7}{11}d.}{4} = £2\ 7s.\ 6\frac{7}{44}d.$

(2) 1. $\frac{3}{5}$ of $£1 = 12s.$; $\frac{2}{7}$ of $21s. = 6s.$;

therefore, value required $= 12s. + 6s. + 3s.\ 2d. = £1\ 1s.\ 2d.$

2.
s. d.
$\frac{3}{8}$ of £1 = 7 . 6
$\frac{3}{8}$ of 2*s*. 6*d*. = 0 . 11$\frac{1}{4}$
$\frac{3}{8}$ of 1*s*. = 0 . 4$\frac{1}{2}$
value required = 8 . 9$\frac{3}{4}$

3.
s. d.
$\frac{1}{7}$ of £1 = 2 . 10$\frac{2}{7}$
$\frac{2}{9}$ of 1*s*. = 0 . 2$\frac{2}{3}$
$\frac{5}{12}$ of 1*d*. = 0 . 0$\frac{5}{12}$
Ans. required = 3 . 1$\frac{31}{84}$

4. $\frac{5}{28}$ of $\frac{11}{18}$ of 10*s*. 6*d*. $= \frac{5 \times 11 \times 21 \times 6}{28 \times 18}d. = \frac{55}{4}d.$ = 1*s*. 1$\frac{3}{4}$*d*.;

$\frac{5}{8}$ of 1*s*. = 7$\frac{1}{2}$*d*. and $\frac{1}{12}$ of 2*s*. 6*d*. = 2$\frac{1}{2}$*d*.;

therefore, value required = 1*s*. 1$\frac{3}{4}$*d*. + 7$\frac{1}{2}$*d*. + 2$\frac{1}{2}$*d*. = 1*s*. 11$\frac{3}{4}$*d*.

5. $\frac{5}{8}$ of £1 = $\frac{100}{8}$*s*. = 12*s*. 6*d*.; $\frac{5}{8}$ of 1*s*. = $\frac{60}{8}$*d*. = 7$\frac{1}{2}$*d*.;

$\frac{5}{8}$ of 21*s*. = $\frac{105}{8}$*s*. = 13*s*. 1$\frac{1}{2}$*d*.; $\frac{5}{8}$ of 27*s*. = $\frac{135}{8}$*s*. = 16*s*. 10$\frac{1}{2}$*d*.;

therefore, value = 12*s*. 6*d*. + 13*s*. 1$\frac{1}{2}$*d*. — 7$\frac{1}{2}$*d*. — 16*s*. 10$\frac{1}{2}$*d*.

= 25*s*. 7$\frac{1}{2}$*d*. — 17*s*. 6*d*. = 8*s*. 1$\frac{1}{2}$*d*.

6.
£ s. d.
£3$\frac{5}{8}$ = 3 . 12 . 6
7$\frac{4}{8}$*s*. = 0 . 7 . 6
4$\frac{3}{4}$*d*. = 0 . 0 . 4$\frac{3}{4}$
value required = 4 . 0 . 4$\frac{3}{4}$

7.
s. d.
$\frac{2}{3}$ of £1 = 13 . 4
$\frac{2}{9}$ of 1*s*. = 0 . 2$\frac{2}{3}$
13 . 6$\frac{2}{3}$
$\frac{5}{6}$ of 2*s*. 6*d*. = 2 . 1
value = 11 . 5$\frac{2}{3}$ = 11*s*. 5$\frac{1}{2}$*d*. $\frac{2}{3}$*q*.

8.
£ s. d.
$\frac{2}{3}$ of 10*s*. 6*d*. = 0 . 7 . 0
$\frac{7}{8}$ of 27*s*. = $\frac{189}{8}$*s*. = 1 . 3 . 7$\frac{1}{2}$
1 . 10 . 7$\frac{1}{2}$
$\frac{6}{11}$ of 6*s*. 8*d*. = $\frac{480}{11}$*d*. = 0 . 3 . 7$\frac{1}{2}$ $\frac{6}{11}$
value required = 1 . 6 . 11$\frac{3}{4}$ $\frac{5}{11}$

9.
£ s. d.
$\frac{7}{64}$ of 32*s*. = 0 . 3 . 6
$\frac{2}{15}$ of £3 5*s*. = 0 . 8 . 8
$\frac{7}{11}$ of $\frac{3}{2}$ of 21*s*. = 1 . 0 . 0$\frac{1}{2}$ $\frac{2}{11}$
value required = 1 . 12 . 2$\frac{1}{2}$ $\frac{2}{11}$

10.
s. d.
$\frac{3}{4}$ of $\frac{5}{8}$ of £1 = $\frac{75}{8}$*s*. = 9 . 4$\frac{1}{2}$
$\frac{2}{3}$ of $\frac{5}{9}$ of 30*d*. = $\frac{100}{9}$*d*. = 0 . 11 $\frac{4}{9}$
$\frac{3}{4}$ of 10$\frac{1}{2}$*d*. = $\frac{63}{8}$*d*. = 0 . 7$\frac{3}{4}$ $\frac{1}{2}$
value required = 10 . 11$\frac{1}{4}$ $\frac{17}{18}$

11.
s. d.
$\frac{2}{9}$ of 21*s*. = $\frac{14}{3}$*s*. = 4 . 8
$\frac{1}{2}$ of $\frac{3}{4}$ of 20*s*. = 7 . 6
$\frac{1}{3}$ of $\frac{5}{8}$ of 12*d*. = 0 . 2$\frac{1}{2}$
12 . 4$\frac{1}{2}$
$\frac{1}{6}$ of $\frac{3}{4}$ of 60*d*. = 0 . 7$\frac{1}{2}$
value required = 11 . 9

12.
£ s. d.
$\frac{3}{7}$ of £15 = £$\frac{45}{7}$ = 6 . 8 . 6$\frac{3}{4}$ $\frac{3}{7}$
$\frac{5}{8}$ of $\frac{5}{14}$ of 32*s*. = $\frac{50}{7}$*s*. = 0 . 7 . 1$\frac{1}{2}$ $\frac{6}{7}$
$\frac{4}{7}$ of 3*d*. = $\frac{12}{7}$*d*. = 0 . 0 . 1$\frac{1}{2}$ $\frac{6}{7}$
value required = 6 . 15 . 10$\frac{1}{4}$ $\frac{1}{7}$*q*.

13. $$\frac{2}{3\frac{1}{2}} \text{ of } \frac{4}{\frac{5}{7}-\frac{1}{9}} \text{ of 2 guineas} = \frac{4}{7} \text{ of } \frac{4\times 63}{45-7} \text{ of } 42s.$$

$$= \frac{4\times 4\times 63\times 42}{7\times 38}s. = \frac{3024}{19}s. = £7\ 19s.\ 1\tfrac{17}{19}d.;$$

$$\frac{1\frac{7}{8}+\frac{3}{4}}{3\frac{4}{5}-\frac{2}{3}} \text{ of } £5 = \frac{1\frac{13}{8}}{3\frac{2}{15}} \text{ of } £5 = \frac{21}{8}\times\frac{15}{47} \text{ of } 100s.$$

$$= \frac{21\times 15\times 25}{2\times 47}s. = \frac{7875}{94}s. = £4\ 3s.\ 9\tfrac{15}{47}d.;$$

$\therefore$ value $= £7\ 19s.\ 1\tfrac{17}{19}d. + £4\ 3s.\ 9\tfrac{15}{47}d. = £12\ 2s.\ 11\tfrac{191}{893}d.$

14. $$\frac{3}{5}\text{ ton} = \left(\frac{3\times 20}{5}\right)\text{ cwt.} = 12\text{ cwt.}$$

$$\frac{5}{8}\text{ cwt.} = \left(\frac{5\times 112}{8}\right)\text{ lbs.} = (5\times 14)\text{ lbs.} = 2\text{ qrs. }14\text{ lbs.}$$

$$\frac{2}{3}\text{ lb.} = \left(\frac{2\times 16}{3}\right)\text{ oz.} = 10\text{ oz. }10\tfrac{2}{3}\text{ drs.};$$

$\therefore$ value $= 12$ cwt. 2 qrs. 14 lbs. 10 oz. $10\frac{2}{3}$ drs.

15. $$\begin{aligned}
\frac{3}{8}\text{ lb. troy} &= \left(\frac{3\times 12}{8}\right)\text{ oz.} &&= 4\text{ oz. }10\text{ dwts.}\\
\frac{5}{6}\text{ lb. troy} &= \left(\frac{5\times 12}{6}\right)\text{ oz.} &&= 10\text{ oz.}\\
& &&\overline{14\text{ oz. }10\text{ dwts.}}\\
\frac{8}{9}\text{ oz. troy} &= \left(\frac{8\times 20}{9}\right)\text{ dwts.} &&= \quad 17\text{ dwts. }18\tfrac{2}{3}\text{ grs.}\\
& \text{Value} &&= \overline{1\text{ lb. }1\text{ oz. }12\text{ dwts. }5\tfrac{1}{3}\text{ grs.}}
\end{aligned}$$

16. $$\begin{aligned}
& &&\text{fur. po. yds.}\\
\frac{7}{10}\text{ mile} &= \left(\frac{7\times 8}{10}\right)\text{ fur.} &&= 5\ .\ 24\\
\frac{5}{8}\text{ fur.} &= \left(\frac{5\times 40}{8}\right)\text{ po.} &&= \quad\ \ 25\\
& &&\overline{4\ .\ 39}\\
\frac{4}{11}\text{ po.} &= \left(\frac{4\times 5\frac{1}{2}}{11}\right)\text{yds.} &&= \qquad\ .\ 2\\
& \text{Value} &&= \overline{4\ .\ 39\ .\ 2}
\end{aligned}$$

c. ft. c. in.

17. $\frac{9}{111}$ cub. yds. = $\left(\frac{9 \times 27}{111}\right)$ c. ft. = 2 . $326\frac{34}{37}$

$2\frac{7}{8}$ cub. ft. = 2 c. ft. + $\frac{7 \times 1728}{8}$ in. = 2 . 1512

Value = 5 . $110\frac{34}{37}$

bus. pk.

18. $\frac{2}{3}$ of a qr. = $\frac{2 \times 8}{3}$ bus. = 5 . $1\frac{1}{3}$

$\frac{3}{4}$ bus. = $\frac{3 \times 4}{4}$ pk. = 3

6 . $0\frac{1}{3}$

$\frac{1}{6}$ qr. = $\frac{1 \times 8}{6}$ bus. = 1 . $1\frac{1}{3}$

Value = 4 . 3

19. $\frac{3}{5}$ of 7 fur. 29 po. 3 yds. 9 in. = $\frac{\text{23 fur. 7 po. 9 yd. 2 ft. 3 in.}}{5}$

= 4 fur. 25 po. 4 yds. 0 ft. $5\frac{2}{5}$ in.

m. fur. po. yds. in.

$\frac{5}{7}$ of 5m. 3f. 37po. $4\frac{1}{5}$ = $\frac{\text{27m. 3f. 37po. }4\frac{1}{2}\text{yds.}}{7}$ = 3 . 7 . 15 . 3 . 0

4 . 25 . 4 . $5\frac{2}{5}$

Value = 4 . 4 . 1 . $1\frac{1}{2}$. $5\frac{2}{5}$

20. $7\frac{2}{5}$ of $365\frac{1}{4}$ days = $\frac{37}{5}$ of $\frac{1461}{4}$ days = $\frac{54057}{20}$ days = 2702 days 20 h. 24 m.

$3\frac{9}{10}$ of $\frac{5}{6}$ wks. = $\frac{39 \times 5 \times 7}{10 \times 6}$ days = $\frac{13 \times 7}{2 \times 2}$ days = $\frac{91}{4}$ days = 22 days 18 h.

$\frac{3}{4}$ of $5\frac{5}{9}$ hrs. = $\frac{3 \times 50}{4 \times 9}$ hrs. = 4 hrs. 10 m.

∴ value required = 2725 days 18 hrs. 34 m.

ac. ro. po. yds.

21. $\frac{1}{11}$ of 91 ac. 3 ro. 36 po. $2\frac{3}{4}$ yds. = 8 . 1 . 17 . 25

$\frac{3}{5}$ of 6 ac. 2 ro. 17 po. $25\frac{1}{2}$ yds.

= $\frac{\text{19 ac. 3 ro. 13 po. }15\frac{1}{2}\text{ yds.}}{5}$ = 3 . 3 . 34 . $21\frac{1}{4}$

Value required = 4 . 1 . 23 . $3\frac{3}{4}$

Ex. XLIX. (p. 142.)

(1) 1. $6s.\ 8d. = 80d.$, and $£1 = 240d.$;

$$\therefore \text{fraction} = \frac{80}{240} = \frac{1}{3}.$$

$3s.\ 1\frac{1}{2}d. = 75$ halfpence, and 1 guinea $= (21 \times 12 \times 2)$ halfpence;

$$\therefore \text{fraction} = \frac{75}{21 \times 12 \times 2} = \frac{25}{168}.$$

2. $5d. = 5d.$, and $1s. = 12d.$;

$$\therefore \text{fraction} = \frac{5}{12}.$$

$3s.\ 4\frac{1}{2}d. = 81$ halfpence, and $£1 = (20 \times 12 \times 2)$ halfpence;

$$\therefore \text{fraction} = \frac{81}{20 \times 12 \times 2} = \frac{27}{160}.$$

3. $7\frac{1}{2}d. = 15$ halfpence, and $27s. = (27 \times 12 \times 2)$ halfpence;

$$\therefore \text{fraction} = \frac{15}{27 \times 12 \times 2} = \frac{5}{216}.$$

15 sixpences $= 90d.$, and $13s.\ 4d. = 160d.$;

$$\therefore \text{fraction} = \frac{90}{160} = \frac{9}{16}.$$

4. $£1\ 3s.\ 4d. = 280d.$, and $£9\ 6s.\ 8d. = 2240d.$;

$$\therefore \text{fraction} = \frac{280}{2240} = \frac{7}{56} = \frac{1}{8}.$$

$2s.\ 0\frac{1}{4}d. = 97q.$, and $10s.\ 6d. = 504q.$;

$$\therefore \text{fraction} = \frac{97}{504}.$$

5. $£4\ 17s.\ 6d. = 195$ sixpences, and $£5 = (5 \times 20 \times 2)$ sixpences;

$$\therefore \text{fraction} = \frac{195}{5 \times 20 \times 2} = \frac{39}{40}.$$

$16s. = 16s.$, and $£200 = (200 \times 20)s.$;

$$\therefore \text{fraction} = \frac{16}{200 \times 20} = \frac{1}{50 \times 5} = \frac{1}{250}.$$

6. $£18\ 7s.\ 6d. = 735$ sixpences, and $£2 = (2 \times 20 \times 2)$ sixpences;

$$\therefore \text{fraction} = \frac{735}{2 \times 20 \times 2} = \frac{147}{16}.$$

$$6s.\ 7\tfrac{6}{7}d. = 79\tfrac{6}{7}d. = \frac{559}{7}\,d.,\ \text{and } 7s.\ 9d. = 93d.;$$

$$\therefore \text{ fraction} = \frac{559}{7\times 93} = \frac{559}{651}.$$

7. $$1s.\ 2d. = 14d.,\ \text{and a moidore} = (27\times 12)d.;$$

$$\therefore \text{ fraction} = \frac{14}{27\times 12} = \frac{7}{162}.$$

$$3s.\ 4d. = 40d.,\ \text{and } 10s.\ 6d. = 126d.;$$

$$\therefore \text{ fraction} = \frac{40}{126} = \frac{20}{63}.$$

8. $$3\text{ qrs. } 19\text{ lbs.} = 103\text{ lbs., and a ton} = (20\times 112)\text{ lbs.};$$

$$\therefore \text{ fraction} = \frac{103}{20\times 112} = \frac{103}{2240}.$$

$$61\tfrac{7}{8}\text{ lbs.} = \left(\frac{495}{8}\times 16\right)\text{oz.} = 990\text{ oz.};$$

$$\therefore \text{ fraction} = \frac{990}{4} = \frac{495}{2}.$$

9. $$3\text{ qrs. } 4\text{ lbs.} = 88\text{ lbs., and } 2\text{ cwt.} = (2\times 112)\text{ lbs.};$$

$$\therefore \text{ fraction} = \frac{88}{2\times 112} = \frac{44}{112} = \frac{11}{28}.$$

$$5\text{ oz. } 2\tfrac{2}{3}\text{ drs.} = 42\tfrac{2}{3}\text{ drs.} = \left(\frac{128}{3}\times 3\times 20\right)\text{grs.} = 2560\text{ grs.};$$

$$\therefore \text{ fraction} = \frac{2560}{1}.$$

10. $$3\text{ ro. } 27\tfrac{1}{2}\text{ po.} = 147\tfrac{1}{2}\text{ po.} = \frac{295}{2}\text{ po., and } 1\text{ ac.} = (1\times 4\times 40)\text{ po.};$$

$$\therefore \text{ fraction} = \frac{295}{2\times 4\times 40} = \frac{59}{2\times 4\times 8} = \frac{59}{64}.$$

$$26\tfrac{2}{5}\text{ sq. yds.} = \frac{132}{5}\text{ sq. yds., and } 2\text{ ac.} = (2\times 4840)\text{ sq. yds.};$$

$$\therefore \text{ fraction} = \frac{132}{5\times 2\times 4840} = \frac{12}{10\times 440} = \frac{3}{1100}.$$

11. $$126\text{ yds. } 2\text{ ft. } 6\text{ in.} = 4566\text{ in., and } 1\text{ mile} = (1760\times 3\times 12)\text{ in.};$$

$$\therefore \text{ fraction} = \frac{4566}{1760\times 3\times 12} = \frac{761}{1760\times 6} = \frac{761}{10560}.$$

$$6\text{ c. ft. } 100\text{ c. in.} = 10468\text{ c. in., and } 1\text{ c. yd.} = (27\times 1728)\text{ c. in.};$$

$$\therefore \text{ fraction} = \frac{10468}{27\times 1728} = \frac{2617}{27\times 432} = \frac{2617}{11664}.$$

12. 2 qrs. $2\frac{2}{3}$ na. $= 10\frac{2}{3}$ na. $= \frac{32}{3}$ na.; and 1 Eng. ell $= (5 \times 4)$ na.;

$$\therefore \text{fraction} = \frac{32}{3 \times 5 \times 4} = \frac{8}{15}.$$

8 h. 3 m. = 483 m., and 1 day $= (24 \times 60)$ m.;

$$\therefore \text{fraction} = \frac{483}{24 \times 60} = \frac{161}{480}.$$

13. 1 st. 8 lbs. = 22 lbs., and 1 ton $= (20 \times 112)$ lbs.;

$$\therefore \text{fraction} = \frac{22}{20 \times 112} = \frac{11}{1120}.$$

1 sc. 13 grs. = 33 grs., and 1 lb. $= (12 \times 8 \times 3 \times 20)$ grs.;

$$\therefore \text{fraction} = \frac{33}{12 \times 8 \times 20} = \frac{11}{1920}.$$

14. 2 ac. 1 ro. = 9 ro., and 9 ac. 2 ro. = 38 ro.;

$$\therefore \text{fraction} = \frac{9}{38}.$$

1540 yds. 2 ft. 9 in. = 55473 in., and 2 miles $= (2 \times 1760 \times 3 \times 12)$ in.;

$$\therefore \text{fraction} = \frac{55473}{2 \times 1760 \times 3 \times 12} = \frac{18491}{24 \times 1760} = \frac{1681}{24 \times 160} = \frac{1681}{3840}.$$

15. 1 ft. $\frac{7}{8}$ in. $= 144\frac{7}{8}$ sq. in. $= \frac{1159}{8}$ sq. in., and 1 sq. yd. $= (9 \times 144)$ sq. in.;

$$\therefore \text{fraction} = \frac{1159}{9 \times 144 \times 8} = \frac{1159}{10368}.$$

2 qts. $1\frac{1}{2}$ pt. $= 5\frac{1}{2}$ pts. $= \frac{11}{2}$ pts., and 1 bar. $= (36 \times 8)$ pts.;

$$\therefore \text{fraction} = \frac{11}{2 \times 36 \times 8} = \frac{11}{576}.$$

16. 2 wks. 5 d. 7 h. 27 m. = 27807 m., and 1 day $= (24 \times 60)$ m.;

$$\therefore \text{fraction} = \frac{27807}{24 \times 60} = \frac{9269}{480}.$$

1 ro. 20 po. = 60 po., and 1 ac. $= (4 \times 40)$ po.;

$$\therefore \text{fraction} = \frac{60}{4 \times 40} = \frac{6}{16} = \frac{3}{8}.$$

17. 4 bus. $2\frac{2}{9}$ qt. $= 130\frac{2}{9}$ qt. $= \frac{1172}{9}$ qt., and 1 ld. $= (5 \times 8 \times 4 \times 8)$ qts.;

$$\therefore \text{fraction} = \frac{1172}{9 \times 5 \times 8 \times 4 \times 8} = \frac{293}{9 \times 40 \times 8} = \frac{293}{2880}.$$

3 quires 7 sh. = 79 sheets, and 1 ream = (20 × 24) sheets;

$$\therefore \text{fraction} = \frac{79}{20 \times 24} = \frac{79}{480}.$$

18. $2\frac{1}{2}$ guineas $= \frac{5 \times 21}{2}$ *s.*, and £$2\frac{1}{2} = \frac{5 \times 20}{2}$ *s.*;

$$\therefore \text{fraction} = \frac{\frac{5}{2} \times 21}{\frac{5}{2} \times 20} = \frac{21}{20}.$$

$2\frac{1}{2}$ cwt. $= \frac{5 \times 112}{2}$ lbs., and 2 tons 12 lbs. = 4492 lbs.;

$$\therefore \text{fraction} = \frac{5 \times 56}{4492} = \frac{5 \times 14}{1123} = \frac{70}{1123}.$$

19. $10\frac{5}{6}$ mo. $= \frac{65}{6}$ mo.; $\quad \therefore$ fraction $= \frac{65}{6 \times 13} = \frac{5}{6}$.

$100\frac{1}{2}$ guineas $= \frac{201}{2}$ gui. $= \frac{201 \times 21 \times 3}{2}$ groats;

$$\therefore \text{fraction} = \frac{201 \times 21 \times 3}{2} = \frac{12663}{2}.$$

20. 6 ft. $3\frac{5}{8}$ in. $= 75\frac{5}{8}$ in., and 13 ft. $8\frac{9}{10}$ in. $= 164\frac{9}{10}$ in.;

$$\therefore \text{fraction} = \frac{75\frac{5}{8}}{164\frac{9}{10}} = \frac{605 \times 10}{1649 \times 8} = \frac{605 \times 5}{1649 \times 4} = \frac{3025}{6596}.$$

$1\frac{1}{2}$ yds. $= \frac{3 \times 3 \times 12}{2}$ in., and $1\frac{1}{2}$ in. $= \frac{3}{2}$ in.;

$$\therefore \text{fraction} = \frac{3 \times 3 \times 12 \times 2}{2 \times 3} = \frac{36}{1}.$$

(2) 1. $\frac{3}{4}$ of 5*s.* $= \frac{3 \times 5}{4}$ *s.*, and £1 = 20*s.*;

$$\therefore \text{fraction} = \frac{3 \times 5}{4 \times 20} = \frac{3}{16}.$$

$\frac{4}{5}$ of a farthing $= \frac{4}{5}$ *q.*, and 1*s.* = 48*q.*;

$$\therefore \text{fraction} = \frac{4}{5 \times 48} = \frac{1}{60}.$$

2. $\frac{5}{7}$ of 1*s.* $= \frac{5}{7}$ *s.*, and a guinea = 21*s.*;

$$\therefore \text{fraction} = \frac{5}{7 \times 21} = \frac{5}{147}.$$

$\frac{1}{8}$ of 7*s.* = $\frac{7}{8}$*s.*, and a crown = 5*s.*;

$$\therefore \text{fraction} = \frac{7}{8 \times 5} = \frac{7}{40}.$$

3. $\frac{3}{5}$ of a guinea $= \frac{3 \times 21}{5}$ *s.*, and £1 = 20*s.*;

$$\therefore \text{fraction} = \frac{3 \times 21}{5 \times 20} = \frac{63}{100}.$$

$\frac{7}{9}$ of 27*s.* $= \frac{7 \times 27 \times 2}{9}$ sixpences, and 2*s.* 6*d.* = 5 sixpences;

$$\therefore \text{fraction} = \frac{7 \times 27 \times 2}{9 \times 5} = \frac{42}{5}.$$

4. $\frac{4}{5}$ of 10*s.* 6*d.* $= \frac{4 \times 21}{5}$ sixpences, and £1 = 40 sixpences;

$$\therefore \text{fraction} = \frac{4 \times 21}{5 \times 40} = \frac{21}{50}.$$

$\frac{25}{12}$ of 1*s.* $= \frac{25 \times 2}{12}$ sixpences, and 2*s.* 6*d.* = 5 sixpences;

$$\therefore \text{fraction} = \frac{25 \times 2}{12 \times 5} = \frac{5}{6}.$$

5. $\frac{1}{8}$ of £74. 13*s.* 4*d.* = £9. 6*s.* 8*d.* = £$9\frac{1}{3}$ = £$\frac{28}{3}$;

$$\therefore \text{fraction} = \frac{28}{3 \times 28} = \frac{1}{3}.$$

$\frac{1}{9}$ of 27*s.* = 3*s.* = 6 sixpences, and $3\frac{1}{2}$ guineas = 147 sixpences;

$$\therefore \text{fraction} = \frac{6}{147} = \frac{2}{49}.$$

6. $\frac{3}{5}$ of a dwt. $= \frac{3}{5}$ dwt., and 1 lb. = (12 × 20) dwts.;

$$\therefore \text{fraction} = \frac{3}{5 \times 12 \times 20} = \frac{1}{400}.$$

$\frac{5}{6}$ of 2 lbs. $= \frac{5}{3}$ lb., and $2\frac{1}{2}$ tons = (50 × 112) lbs.;

$$\therefore \text{fraction} = \frac{5}{3 \times 50 \times 112} = \frac{1}{3360}.$$

7. $\frac{3}{8}$ of a lb. $= \frac{3}{8}$ lb., and 1 cwt. = 112 lbs.;

$$\therefore \text{fraction} = \frac{3}{8 \times 112} = \frac{3}{896}.$$

$$\frac{5}{6} \text{ of a yard} = \frac{5}{6} \text{ yd., and } 1 \text{ mile} = 1760 \text{ yds.};$$

$$\therefore \text{ fraction} = \frac{5}{6 \times 1760} = \frac{1}{6 \times 352} = \frac{1}{2112}.$$

8. $$\frac{1}{300} \text{ of £}1 = \frac{20 \times 12}{300}\, d.; \ \therefore \text{ fraction} = \frac{20 \times 12}{300 \times 1} = \frac{12}{15} = \frac{4}{5}.$$

$$\frac{3}{9680} \text{ of a mile} = \frac{3 \times 1760}{9680} \text{ yards};$$

$$\therefore \text{ fraction} = \frac{3 \times 1760}{9680 \times 1} = \frac{3 \times 16}{88} = \frac{6}{11}.$$

9. $$\frac{2}{5} \text{ of } \frac{4}{7} \text{ of } 10s.\ 6d. = \frac{2 \times 4 \times 21}{5 \times 7} \text{ sixpences, and } 2s.\ 6d. = 5 \text{ sixpences};$$

$$\therefore \text{ fraction} = \frac{2 \times 4 \times 21}{5 \times 7 \times 5} = \frac{24}{25}.$$

$$1 \text{ lb. troy} = 5760 \text{ grs.}; \quad \therefore 1 \text{ oz. troy} = \frac{5760}{12} \text{ grs.}$$

$$1 \text{ lb. av.} = 7000 \text{ grs.}; \quad \therefore 1 \text{ oz. av.} = \frac{7000}{16} \text{ grs.};$$

$$\therefore \text{ fraction} = \frac{5760 \times 16}{7000 \times 12} = \frac{576 \times 4}{700 \times 3} = \frac{192}{175}.$$

10. $$\frac{3}{7} \text{ of a pole} = \frac{3}{7} \text{ po., and } 1 \text{ league} = (3 \times 8 \times 40) \text{ po.};$$

$$\therefore \text{ fraction} = \frac{3}{7 \times 3 \times 8 \times 40} = \frac{1}{2240}.$$

$$3\tfrac{7}{8} \text{ fur.} = \frac{31}{8} \text{ fur., and } 2\tfrac{7}{8} \text{ miles} = 23 \text{ fur.};$$

$$\therefore \text{ fraction} = \frac{31}{8 \times 23} = \frac{31}{184}.$$

11. $$\frac{3}{5} \text{ of } 7\tfrac{1}{2} \text{ of } 16\tfrac{1}{2} \text{ yds.} = \overset{\text{yds.}}{\frac{3 \times 15 \times 33}{5 \times 2 \times 2}} = \overset{\text{yds.}}{\frac{3 \times 3 \times 33}{4}}, \text{ and } 1 \text{ furlong} = 220 \text{ yds.};$$

$$\therefore \text{ fraction} = \frac{3 \times 3 \times 33}{4 \times 220} = \frac{27}{80}.$$

$$\frac{1}{7} \text{ of } \frac{2}{11} \text{ of a guinea} = \frac{2 \times 21 \times 2}{7 \times 11} \text{ sixpences, and } 2s.\ 6d. = 5 \text{ sixpences};$$

$$\therefore \text{ fraction} = \frac{2 \times 21 \times 2}{7 \times 11 \times 5} = \frac{12}{55}.$$

8. $\frac{7}{183}$ of 28 days $=\frac{7\times28\times24\times60}{183}$ min.;

$$\therefore \text{fraction}=\frac{\frac{7}{183}\times28\times24\times60}{\frac{1}{30}}=\frac{7\times28\times24\times60\times30}{183}$$

$$=\frac{7\times28\times24\times60\times10}{61}=\frac{2822400}{61}.$$

9. $3\frac{1}{4}$ hhds. $=\frac{13}{4}$ hhds., and $\frac{1}{3}$ of 4 tuns $=\frac{4\times4}{3}$ hhds.;

$$\therefore \text{fraction}=\frac{13\times3}{4\times4\times4}=\frac{39}{64}.$$

10. $\frac{3}{14}$ of $\frac{7}{3}$ of a pole $=\left(\frac{3}{14}\times\frac{7}{3}\times\frac{11}{2}\times3\right)$ feet $=\frac{33}{4}$ feet,

3 fathoms $=(3\times6)$ ft.;

$$\therefore \text{fraction}=\frac{33}{4\times3\times6}=\frac{11}{24}.$$

Ex. L. (p. 146.)

(1) $\frac{1}{19}$ of £1 $=\frac{20}{19}$ *s.* $\frac{1}{20}$ of a guinea $=\frac{21}{20}$ *s.*

$\frac{8}{35}$ of a crown $=\frac{8\times5}{35}$ *s.* $=\frac{8}{7}$ *s.*;

∴ the fractions to be compared are

$$\frac{20}{19},\ \frac{21}{20}\text{ and }\frac{8}{7},$$

and these become, since $19\times20\times7$ is L. C. Den.

$$\frac{2800}{2660},\ \frac{2793}{2660},\ \frac{3040}{2660}.$$

∴ $\frac{8}{35}$ of a crown is the greatest, $\frac{1}{19}$ of £1 the next, and $\frac{1}{20}$ of a guinea the least.

(2) $\frac{7}{8}$ of £1 $=17$*s.* 6*d.*, $\frac{5}{6}$ of 21*s.* $=\frac{5\times7}{2}$ *s.* $=17$*s.* 6*d.*,

$\frac{2}{3}$ of 15*s.* 7½*d.* $=\frac{1}{3}$ of 31*s.* 3*d.* $=10$*s.* 5*d.*;

∴ the first two are equal, the third less.

(3) $\frac{1}{25}$ of a day $=\frac{24}{25}$ hrs.;

∴ we have to compare the fractions

$\frac{24}{25}$ and $\frac{6}{7}$, or $\frac{168}{175}$ and $\frac{150}{175}$;

∴ $\frac{1}{25}$ of a day is greater by $\frac{18}{175}$ of an hour.

(4) $\frac{1}{12}$ of £1 $-\frac{1}{14}$ of 1 guinea,

$=\left(\frac{20}{12}-\frac{21}{14}\right)s.=\left(\frac{5}{3}-\frac{3}{2}\right)s.=\frac{1}{6}s.=2d.$, and $2s.\ 6d.=30d.$;

∴ fraction $=\frac{2}{30}=\frac{1}{15}$.

(5) $\frac{7}{9}$ of £1 $-\frac{2}{5}$ of a guinea,

$=\left(\frac{7\times 40}{9}-\frac{2\times 42}{5}\right)$ sixpences $=\frac{644}{45}$ sixpences, and $10s.\ 6d.=21$ sixpences;

∴ fraction $=\frac{644}{45\times 21}=\frac{92}{135}$.

(6) $\frac{3}{8}$ of a crown $+\frac{4}{5}$ of a shilling $=\left(\frac{3\times 5}{8}+\frac{4}{5}\right)s.=\frac{107}{40}s.$;

∴ fraction $=\frac{107}{40\times 21}=\frac{107}{840}$.

(7) $\frac{3}{8}$ of $2s.\ 6d.+\frac{4}{5}$ of a guinea $+\frac{5}{3}$ of £1 $-\frac{1}{10}d.$,

$=\left(\frac{3\times 30}{8}+\frac{4\times 12\times 21}{5}+\frac{5\times 20\times 12}{3}-\frac{1}{10}\right)d.$,

$=\left(\frac{45}{4}+\frac{1008}{5}+\frac{400}{1}-\frac{1}{10}\right)d.=\frac{12255}{20}d.=\frac{2451}{4}d.$,

and £5 $=(5\times 20\times 12)d.$;

∴ fraction $=\frac{2451}{5\times 20\times 12\times 4}=\frac{817}{1600}$.

(8) $\frac{3}{5}$ of £3. 7s. 6d. $=\frac{1}{5}$ of £10. 2s. 6d. $=$ £2. 0s. 6d.,

$\frac{2}{3}$ of $\frac{1}{4}$ of $4\frac{1}{2}$ guineas $=\frac{3}{4}$ of $21s.=15s.\ 9d.$;

∴ difference = £2. 16*s*. 3*d*. = 56¼*s*., and £2 = 40*s*.;

$$\therefore \text{fraction} = \frac{225}{4 \times 40} = \frac{45}{4 \times 8} = \frac{45}{32}.$$

(9) 5 guineas — 3½ guineas = 1½ guineas;

∴ we have to reduce 1½ guineas to the fraction of £10.

$$1\tfrac{1}{2} \text{ guineas} = \frac{3 \times 21}{2}\,s., \text{ and } £10 = 200s.;$$

$$\therefore \text{fraction} = \frac{63}{2 \times 200} = \frac{63}{400}.$$

(10)

$$\begin{array}{l} \text{1 ton 10 cwt.} \\ \qquad\qquad\text{3 qrs. 14 lbs.} \\ \hline \text{1 ton 9 cwt. 0 qrs. 14 lbs.} = 3262 \text{ lbs.,} \end{array}$$

and $2\tfrac{1}{2}$ cwt. = $(\frac{5}{2} \times 112)$ lbs. = 280 lbs.;

$$\therefore \text{fraction} = \frac{3262}{280} = \frac{1631}{140} = \frac{233}{20}.$$

Ex. LI. (p. 150.)

(1) 1.

$$\begin{array}{r} £ \\ \cdot 45 \\ 20 \\ \hline 9\cdot 00\ s. \end{array}$$

Ans. 9*s*.

$$\begin{array}{r} £ \\ \cdot 16875 \\ 20 \\ \hline 3\cdot 37500\ s. \\ 12 \\ \hline 4\cdot 50000\,d. \\ 4 \\ \hline 2\cdot 00000\ q. \end{array}$$

Ans. 3*s*. 4½*d*.

$$\begin{array}{r} £ \\ \cdot 87708 \\ 20 \\ \hline 17\cdot 54160\ s. \\ 12 \\ \hline 6\cdot 49920\,d. \\ 4 \\ \hline 1\cdot 99680\,q. \end{array}$$

Ans. 17*s*. 6¼*d*. ·9968*q*.

2.

$$\begin{array}{r} £ \\ \cdot 28125 \\ 20 \\ \hline 5\cdot 62500\ s. \\ 12 \\ \hline 7\cdot 50000\ d. \\ 4 \\ \hline 2\cdot 00000\ q. \end{array}$$

Ans. 5*s*. 7½*d*.

$$\begin{array}{r} £ \\ \cdot 7962 \\ 20 \\ \hline 15\cdot 9240\,s. \\ 12 \\ \hline 11\cdot 0880\ d. \end{array}$$

Ans. 15*s*. 11*d*. ·088*q*.

$$\begin{array}{r} £ \\ \cdot 359375 \\ 40 \\ \hline 14\cdot 375000\ s. \\ 12 \\ \hline 4\cdot 500000\ d. \\ 4 \\ \hline 2\cdot 000000\ q. \end{array}$$

Ans. 14*s*. 4½*d*.

3. £
5·00625
20
·12500 *s.*
12
1·50000 *d.*
4
2·00000 *q.*

Ans. £5. 0*s.* 1½*d.*

£
·775625
5
3·878125 £.
20
17·562500 *s.*
12
6·750000 *d.*
4
3·000000 *q.*

Ans. £3. 17*s.* 6¾*d.*

·6875
16
41250
6875
11·0000 *s.*

Ans. 11*s.*

4. guinea.
·0625
21
625
1250
13·125 *s.*
12
1·500 *d.*
4
2·000 *q.*

Ans. 13*s.* 1½*d.*

s.
·7635
10
7·635 *s.*
12
7·620 *d.*
4
2·480 *q.*

Ans. 7*s.* 7½*d.* ·48*q.*

s.
2·625
12
7·500 *d.*
4
2·000 *q.*

Ans. 2*s.* 7½*d.*

5. guinea.
·056713
21
56713
113426
1·190973 *s.*
12
2·291676 *d.*
4
1·166704 *q.*

Ans. 1*s.* 2¼*d.* ·166704*q.*

£
2·76543
20
15·30860 *s.*
12
3·70320 *d.*
4
2·81280 *q.*

Ans. £2. 15*s.* 3½*d.* ·8128*q.*

s.
1·74375
10
17·4375 *s.*
12
5·2500 *d.*
4
1·0000 *q.*

Ans. 17*s.* 5¼*d.*

6. £
3·049
20
·980 *s.*
12
11·760 *d.*
4
3·040 *q.*

Ans. £3. 0*s.* 11¾*d.* ·04*q.*

£
·0425
100
4·25 £.
20
5·00 *s.*

Ans. £4. 5*s.*

d.
·432
160
25920
432
69·120 *d.*

Ans. 5*s.* 9·12*d.*

8. *d.*
3·10532
·150
15526600
310532
465·79800 *d.*
4
3·19200 *q.*

Ans. £1. 18*s.* 9¾*d.* ·192*q.*

d.
27·5
28
2200
550
770·0 *d.*

Ans. £3. 4*s.* 2*d.*

d.
41·375
8
331·000 *d.*

Ans. £1. 7*s.* 7*d.*

7. *s.*
·1875
105
9375
18750
19·6875 *s.*
12
8·2500 *d.*
4
1·0000 *q.*

Ans. 19*s.* 8¼*d.*

d.
1·05625
80
84·50000 *d.*
4
2·00000 *q.*

Ans. 7*s.* 0½*d.*

d.
·875
786
5250
7000
6125
687·750 *d.*
4
3·000

Ans. £2. 17*s.* 3¾*d.*

10. £
6·156510416
4
24·626041664 £.
20
12·520833280 *s.*
12
6·249999360 *d.*

Ans. £24. 12*s.* 6·24999936*d.*

lb.
·046875
96
281250
421875
4·500000

Ans. 4½ lbs.

11.
cwt.
·85076
4
3·40304 qrs.
28
322432
80608
11·28512 lbs.
16
171072
28512
4·56192 oz.
Ans. 3 qrs. 11 lbs. 4·56192 oz.

cwt.
·07325
4
·29300 qrs.
28
234400
58600
8·20400 lbs.
16
122400
20400
3·26400 oz.
Ans. 8 lbs. 3·264 oz.

mile.
·045
8
·360 fur.
40
14·400 po.
5½
2000
200
2·200 yds.
36
7·200 in.
Ans. 14 po. 2 yds. 7·2 in.

12.
tons.
4·16525
20
3·30500 cwt.
4
1·22000 qrs.
28
6·16000 lbs.
16
2·56000 oz.
Ans. 4 tons 3 cwt. 1 qr. 6 lbs. 2·56 oz.

cwt.
3·625
4
2·500 qrs.
28
14·000 lbs.
Ans. 3 cwt. 2 qrs. 14 lbs.

acre.
·05
4
·20 ro.
40
8·00 po.
Ans. 8 sq. poles.

9.
league.
·875
3
2·625 mi.
1760
37500
4375
625
1100·000 yds.
Ans. 2 mi. 1100 yds.

days.
2·5384375
24
21537500
10768750
12·9225000 hrs.
60
55·3500 m.
60
21·00 sec.
Ans. 2 days 12 hrs. 55 min. 21 sec.

lb. troy.
·6
12
7·2 oz.
20
4·0 dwts.
Ans. 7 oz. 4 dwts.

13. lbs. troy.
3·8343
12
10·0116 oz.
20
·2320 dwts.
24
9280
4640
5·5680 grs.
Ans. 3 lbs. 10 oz. 5·568 grs.

qrs.
2·46875
8
3·75000 bush.
4
3·00000 pks.
Ans. 2 qrs. 3 bus. 3 pks.

lbs.
4·106
385
20530
32848
12318
1580·810 lbs.
16
4860
810
12·960 oz.
Ans. 1580 lbs. 12·96 oz.
= 14 cwt. 12 lbs. 12·96 oz.

14. ac.
3·8375
4
3·3500 ro.
40
14·0000 po.
Ans. 3 ac. 3 ro. 14 po.

gall.
3·5
18
280
35
63·0 gall.
Ans. 63 gallons.

15. fur.
·925
40
37·000 po.
Ans. 37 poles.

lun. mo.
·34375
28
275000
68750
9·62500 days
24
250000
125000
15·00000 hrs.
Ans. 9 days 15 hrs.

20. miles
2·009943
2
4·019886 mi.
8
·159088 fur.
40
6·363520 po.
5½
1817600
181760
1·999360 yds.
3
2·998080 ft.
12
11·976960 in.
Ans. 4 mi. 6 po. 1 yd. 2 ft. 11·97696 in.

s.
1·005
315
5025
1005
3015
316·575 *s.*
12
6·900 *d.*
4
3·600 *q.*
Ans. £15. 16*s.* 6¾*d.* ·6*q.*

16.
£
5·06325
100
506·325 £
20
6·500 *s.*
12
6·000 *d.*

Ans. £506. 6*s.* 6*d.*

Eng. ell.
3·8
5
19·0 qrs.

Ans. 19 qrs.

19.
sq. ft.
4·751
25
23755
9502
118·775 sq. ft.
144
3100
3100
775
111·600 sq. in.

Ans. 13 sq. yds. 1 sq. ft. 111·6 sq. in.

q.
60493
3·0005
302465
120986
121016·2465 *q.*

4 | 121016
12 | 30254
2,0 | 252,1 — 2*d.*

Ans. £126. 1*s.* 2*d.* ·2465*q.*

17.
ro.
2·25
14
900
225
31·50 ro.
40
20·00 po.

Ans. 7 ac. 3 ro. 20 po.

s.
2·465
25
12325
4930
61·625 *s.*
12
7·500 *d.*
4
2·000 *q.*

Ans. £3. 1*s.* 7½*d.*

18.
sixpences.
1·605
125
8025
3210
1605
200·625 sixpences.
6
3·750 *d.*
4
3·000 *q.*

Ans. £5. 0*s.* 3¾*d.*

yards.
2·0396
2290
1835640
40792
40792
4670·6840 yds.
3
2·0520 ft.

Ans. 2 m. 1150 yds. 2·052 ft.

(2) 1.

$$\cdot 38\dot{3} \text{ of } £1 = \frac{383-38}{900} \text{ of } £1 = \frac{345}{900} \text{ of } £1$$

$$= \frac{345 \times 20}{900}\, s. = \frac{23}{3}\, s. = 7s.\ 8d.$$

$\cdot 4708\dot{3}$ of £1 $= \dfrac{47083-4708}{90000}$ of £1

$= \dfrac{42375 \times 20}{90000}s. = \dfrac{113}{12}s. = 9s.\ 5d.$

$\cdot 469\dot{4}$ of 1 lb. troy $= \dfrac{4694-469}{9000}$ of 1 lb. troy

$= \dfrac{4225}{9000}$ lb. troy $= \dfrac{169 \times 12}{360}$ oz.

$= \dfrac{169}{30}$ oz. = 5 oz. 12 dwts. 16 grs.

2. $\cdot 5\dot{7}4\dot{0}$ of $27s. = \dfrac{5740-5}{9990}$ of $27s.$

$= \dfrac{5735 \times 27}{9990}s. = \dfrac{1147}{74}s. = 15s.\ 6d.$

$\cdot 13\dot{8}$ of $10s.\ 6d. = \dfrac{138-13}{900}$ of $126d.$

$= \dfrac{125 \times 126}{900}d. = \dfrac{35}{2}d. = 1s.\ 5\tfrac{1}{2}d.$

$2\cdot 6$ of $5s. = 2\tfrac{6}{9}$ of $5s. = 2\tfrac{2}{3}$ of $5s.$

$= \dfrac{40}{3}s. = 13s.\ 4d.$

3. $\cdot\dot{1}4285\dot{7}$ of 2 guineas $= \dfrac{142857}{99999}$ of $42s.$

$= \dfrac{12987 \times 42}{90909}s. = \dfrac{1443 \times 42}{10101}s.$

$= \dfrac{1443 \times 6}{1443}s. = 6s.$

$\cdot 2\dot{0}95328\dot{8}$ of $17s.\ 6d. = \dfrac{2095328-2}{9999990}$ of $17s.\ 6d.$

$= \left(\dfrac{2095326}{9999990} \times \dfrac{35}{2}\right)s. = \dfrac{407}{111}s. = 3s.\ 8d.,$

and $17s.\ 6d. \times 3 = £2.\ 12s.\ 6d.;$

$\therefore$ value required $= £2.\ 12s.\ 6d. + 3s.\ 8d. = £2.\ 16s.\ 2d.$

4. $\cdot 06\dot{3}$ of 100 guineas $= \left(\dfrac{63-6}{900} \times 100\right)$ guineas

$= \dfrac{57}{9}$ guineas = 6 guineas $7s. = £6.\ 13s.$

$2·013\dot{8}$ of 3·5 moidores $=2\frac{138-13}{9000}$ of 3·5 moidores

$$=\left(2\tfrac{125}{9000}\times\frac{7}{2}\times 27\right)s.=\left(2\tfrac{1}{72}\times\frac{7}{2}\times 27\right)s.=\frac{145\times 7\times 27}{72\times 2}s.$$

$$=\frac{3045}{16}s.=£9.\ 10s.\ 3\tfrac{3}{4}d.$$

5. $4·0\dot{5}$ of $1\frac{1}{2}$ sq. yds. $=\left(4\frac{5}{90}\times\frac{3}{2}\right)$ sq. yds.

$$=\left(4\tfrac{1}{18}\times\frac{3}{2}\right)\text{ sq. yds.}=\frac{73}{12}\text{ sq. yds.}=6\text{ sq. yds. }108\text{ sq. in.};$$

$·16\dot{3}$ of $2\frac{1}{2}$ miles $=\frac{163-16}{900}$ of $2\frac{1}{2}$ miles

$$=\left(\frac{147}{900}\times\frac{5}{2}\right)\text{ miles}=\frac{147}{180\times 2}\text{ miles}$$

$$=\frac{49}{120}\text{ miles}=3\text{ fur. }10\text{ po. }3\text{ yds. }2\text{ ft.};$$

$4·\dot{9}\dot{0}$ of 4 days 3 hrs. $=4\frac{90}{99}$ of 99 hrs.

$$=\frac{396+90}{99}\text{ of }99\text{ hrs.}=486\text{ hrs.}=20\text{ days }6\text{ hrs.}$$

6. $3·24\dot{2}$ of $2\frac{1}{2}$ acres $=\left(3\,\frac{242-24}{900}\times\frac{5}{2}\right)$ acres

$$=\left(3\tfrac{109}{450}\times\frac{5}{2}\right)\text{ acres}=\frac{1459}{180}\text{ acres}=8\tfrac{19}{180}\text{ acres};$$

$$\frac{·093\dot{1}\dot{8}}{·56\dot{8}\dot{1}}\text{ of }2\tfrac{1}{12}\text{ of }2·5\text{ days}=\left(\frac{9318-93}{99000}\times\frac{9900}{5681-56}\times\frac{25}{12}\times\frac{5}{2}\right)\text{ days}$$

$$=\left(\frac{9225}{10}\times\frac{1}{5625}\times\frac{25}{12}\times\frac{5}{2}\right)\text{ days}=\frac{41}{48}\text{ days}=20\text{ hrs. }30\text{ min.}$$

(3)

$$\begin{array}{r} £ \\ ·77777 \\ 20 \\ \hline 15·55540\,s. \\ 12 \\ \hline 6·6480\,d. \end{array} \qquad \begin{array}{rrr} & s. & d. \\ & 15\ . & 6·648 \\ & 8\ . & 6·648 \\ \hline \textit{Ans.} & 7\ . & 0 \end{array}$$

$$\begin{array}{r} £ \\ ·70323 \\ 20 \\ \hline 14·06460\,s. \\ 12 \\ \hline ·77520\,d. \end{array} \qquad \begin{array}{r} s. \\ 3·5646 \\ 12 \\ \hline 6·7752\,d. \end{array} \qquad \begin{array}{rrr} & s. & d. \\ & 14\ . & 0·7752 \\ & 3\ . & 6·7752 \\ \hline \textit{Ans.} & 10\ . & 6 \end{array}$$

(4)

$$\begin{array}{r} \pounds \\ 1{\cdot}59375 \\ 20 \\ \hline 11{\cdot}87500\,s. \\ 12 \\ \hline 10{\cdot}50000\,d. \\ 4 \\ \hline 2{\cdot}00000\,q. \end{array} \qquad \begin{array}{l} \frac{3}{8} \text{ of } 5s. = \frac{15}{8}s. \\ = 1s.\ 10\frac{1}{2}d. \end{array} \qquad \begin{array}{rrcrcr} & \pounds & & s. & & d. \\ & 1 & . & 11 & . & 10\frac{1}{2} \\ & 0 & . & 1 & . & 10\frac{1}{2} \\ \hline Ans. & 1 & . & 10 & . & 0 \end{array}$$

(5) 1.

$$\begin{array}{r} \pounds \\ {\cdot}68125 \\ 20 \\ \hline 13{\cdot}62500\,s. \\ 12 \\ \hline 7{\cdot}50000\,d. \\ 4 \\ \hline 2{\cdot}00000\,q. \end{array} \qquad \begin{array}{r} d. \\ {\cdot}375 \\ 160 \\ \hline 22500 \\ 375 \\ \hline 60{\cdot}000\,d. \end{array} \qquad \begin{array}{r} d. \\ {\cdot}605 \\ 750 \\ \hline 30250 \\ 4235 \\ \hline 453{\cdot}750\,d. \\ 4 \\ \hline 3{\cdot}000\,q. \end{array}$$

therefore, value $= 13s.\ 7\frac{1}{2}d. + 5s. + \pounds1.\ 17s.\ 9\frac{3}{4}d. = \pounds2.\ 16s.\ 5\frac{1}{4}d.$

2. $3\frac{7}{8}$ of $6s.\ 8d. = (\frac{31}{8} \times 80)d. = 310d. = \pounds1.\ 5s.\ 10d.$;

$${\cdot}4097\dot{2} \text{ of a guinea} = \left(\frac{40972-4097}{90000} \times 21\right)s.$$

$$= \left(\frac{36875}{30000} \times 7\right)s. = \frac{413}{48}s. = 8s.\ 7\frac{1}{4}d.$$

$$\begin{array}{r} \pounds \\ 2{\cdot}75 \\ 30 \\ \hline 82{\cdot}50\,\pounds. \\ 20 \\ \hline 10{\cdot}00\,s. \end{array}$$

therefore, value $= \pounds1.\ 5s.\ 10d. - 8s.\ 7\frac{1}{4}d. + \pounds82.\ 10s. = \pounds83.\ 7s.\ 2\frac{3}{4}d.$

3.

$$\begin{array}{r} \pounds \\ {\cdot}634375 \\ 20 \\ \hline 12{\cdot}68750\,s. \\ 12 \\ \hline 8{\cdot}250000\,d. \\ 4 \\ \hline 1{\cdot}000000\,q. \end{array} \qquad \begin{array}{r} s. \\ {\cdot}025 \\ 25 \\ \hline 125 \\ 50 \\ \hline {\cdot}625\,s. \\ 12 \\ \hline 7{\cdot}500\,d. \\ 4 \\ \hline 2{\cdot}000\,q. \end{array} \qquad \begin{array}{l} {\cdot}31\dot{6} \text{ of } 30s. \\ = \frac{316-31}{900} \text{ of } 30s. \\ = \frac{285}{30}s. \\ = \frac{19}{2}s. \\ = 9s.\ 6d. \end{array}$$

therefore, value $= 12s.\ 8\frac{1}{4}d. + 7\frac{1}{2}d. + 9s.\ 6d. = \pounds1.\ 2s.\ 9\frac{3}{4}d.$

4. *d.*
·75
80
60·00 *d.*

s.
1·84375
4
7·37500 *s.*
12
4·50000 *d.*
4
2·00000 *q.*

3·979$\dot{6}$ of 2*s.*
$=6s.+\frac{8817}{4500}s.$
$=7s.\ 11\frac{1}{2}d.\ \frac{6}{125}q.$

therefore value $=5s.-7s.\ 4\frac{1}{2}d.+7s.\ 11\frac{1}{2}d.\ \frac{6}{125}q.$
$=5s.\ 7d.\ \frac{6}{125}q.=5s.\ 7\frac{6}{500}d.=5s.\ 7{\cdot}012d.$

5. 2·$\dot{8}\dot{1}$ of 365¼ days $=\left(2\frac{81}{99}\times\frac{1461}{4}\right)$ days
$=\left(\frac{31\times1461}{11\times4}\right)$ days $=147$ wks. 0 days 8 hrs. 10 m. $54\frac{6}{11}$ sec.

wks.
5·75
7
5·25 days
24
6·00 hrs.

$\frac{3}{4}$ of $5\frac{5}{9}$ hrs. $=\frac{3\times50}{4\times9}$ hrs.
$=\frac{25}{6}$ hrs. $=4$ hrs. 10 m.

therefore value
$=147$ wks. 0 days 8 hrs. 10 m. $54\frac{6}{11}$ sec. + 5 wks. 5 days 6 hrs. — 4 hrs. 10 m.
$=152$ wks. 5 days 10 hrs. 0 m. $54\frac{6}{11}$ sec.

6. $\frac{7}{9}$ of $\frac{3}{14}$ of 3 ac. $=\frac{7\times3\times3}{9\times14}$ ac. $=\frac{1}{2}$ ac. $=2$ ro.

sq. yds.
2·00875
9
·07875 sq. ft.
144
31500
31500
7875
11·34000 sq. in.

·02$\dot{2}\dot{7}$ of $3\frac{1}{2}$ sq. ft.
$=\left(\frac{225}{9900}\times\frac{7}{2}\right)$ sq. ft.
$=\frac{225\times7\times144}{9900\times2}$ sq. in.
$=\frac{5\times7\times18}{55}$ sq. in.
$=11\frac{5}{11}$ sq. in.

therefore value $=2$ ro. -2 sq. yds. $11\frac{17}{50}$ sq. in. $+11\frac{5}{11}$ sq. in.
$=1$ ro. 39 po. $28\frac{1}{4}$ sq. yds. $0\frac{63}{550}$ sq. in.

(6) ·0231 of a guinea $=\frac{231\times21}{10000}s.=\frac{4851}{10000}s.$;

·19 of half-a-crown $=\frac{19\times5}{100\times2}s.=\frac{4750}{10000}s.$;

therefore ·0231 of a guinea is the greater.

Ex. LII. (p. 154.)

(1) 1.

$$\begin{array}{r|l} 12 & 4\cdot00 \\ 2{,}0 & 6\cdot333\dot{3} \\ & \cdot316\dot{6} \end{array}$$

$$\begin{array}{r|l} 2 & 1\cdot0 \\ 12 & 8\cdot5 \\ 2{,}0 & 8\cdot7083\dot{3} \\ & \cdot435416\dot{6} \end{array}$$

2.

$$\begin{array}{r|l} 4 & 2\cdot0 \\ 12 & 7\cdot5 \\ 2{,}0 & 4\cdot625 \\ & \cdot23125 \end{array}$$

$$\begin{array}{r|l} 4 & 1\cdot00 \\ 12 & 11\cdot25 \\ 2{,}0 & 15\cdot9375 \\ & \cdot796875 \end{array}$$

3.

$$\begin{array}{r|l} 2 & 1\cdot0 \\ 12 & 4\cdot5 \\ 5 & 3\cdot375 \\ & \cdot675 \end{array}$$

$$\begin{array}{r|l} 4 & 3\cdot00 \\ 12 & \cdot75 \\ 2{,}0 & \cdot0625 \\ & \cdot003125 \end{array}$$

4.

$$\begin{array}{r|l} 4 & 3\cdot00 \\ 12 & \cdot75 \\ 2{,}0 & 10\cdot0625 \\ & \cdot503125 \end{array}$$

$$\begin{array}{r|l} 4 & 3\cdot00 \\ 12 & 8\cdot75 \\ 2{,}0 & 5\cdot7291\dot{6}6 \\ 5 & \cdot286458\dot{3} \\ & \cdot057291\dot{6} \end{array}$$

5.

$$\begin{array}{r|l} 4 & 1\cdot00 \\ 12 & 3\cdot25 \\ 15\,\{\,3 & 1\cdot2708\dot{3} \\ 5 & \cdot4236\dot{1} \\ & \cdot0847\dot{2} \end{array}$$

$$\begin{array}{r|l} 4 & 2\cdot0 \\ 12 & 1\cdot5 \\ 21\,\{\,3 & 12\cdot125 \\ 7 & 4\cdot041\dot{6} \\ & \cdot577\dot{3}8095\dot{2}380 \end{array}$$

6. *5s.*=60*d.*, and 13*s.* 4*d.*=160*d.*;

therefore fraction $= \frac{60}{160} = \frac{3}{8} = \cdot375.$

$$\begin{array}{r|l} 12 & 9\cdot00 \\ 27\,\{\,3 & 18\cdot75 \\ 9 & 6\cdot25 \\ & \cdot69\dot{4} \end{array}$$

7.

$$\begin{array}{r|l} 12 & 6\cdot0 \\ 10 & 13\cdot5 \\ & 1\cdot35 \end{array}$$

$$\begin{array}{r|l} 4 & 2\cdot0 \\ 12 & 4\cdot5 \\ 2{,}0 & 9\cdot375 \\ & 1\cdot46875 \end{array}$$

8.

$$\begin{array}{r|l} 4 & 3\cdot00 \\ 12 & 9\cdot75 \\ 2{,}0 & 11\cdot8125 \\ & 3\cdot590625 \end{array}$$

$$\begin{array}{r|l} 4 & 3\cdot00 \\ 12 & 9\cdot75 \\ 5{,}0 & 71\cdot8125 \\ & 1\cdot43625 \end{array}$$

9.
$$\begin{array}{r|l} 4 & 3\cdot00 \\ 12 & \cdot75 \\ 21\left\{\begin{matrix}3\\7\end{matrix}\right. & \begin{matrix}14\cdot0625\\4\cdot6875\end{matrix} \\ 3 & \cdot6696\dot{4}2857\dot{1} \\ & \cdot2232\dot{1}42857 \end{array}$$

27*s.* = 54 sixpences,

$1\frac{1}{2}$ guineas = 63 sixpences;

therefore fraction $= \frac{54}{63} = \frac{6}{7}$

$= \cdot\dot{8}5714\dot{2}.$

10. $6\frac{1}{2}$ guineas = 273 sixpences, and £5 = 200 sixpences;

therefore fraction $= \frac{273}{200} = \frac{2\cdot73}{2} = 1\cdot365$;

$$\begin{array}{r|l} 4 & 2\cdot0 \\ 12 & 1\cdot5 \\ 2{,}0 & \cdot125 \\ 100 & \cdot00625 \\ & \cdot0000625 \end{array}$$

11. £8. 0*s.* 10*d.* = 1930*d.* and $5\frac{1}{2}d. = \frac{11}{2}d.$,

therefore fraction $= \frac{1930\times2}{11} = \frac{3860}{11} = 350\cdot\dot{9}\dot{0}$;

7 guineas = 1764*d.* and £5. 10*s.* 11*d.* = 1331*d.*,

therefore fraction $= \frac{1764}{1331} = 1\cdot325319308\ldots\ldots$

12.
$$\begin{array}{r|l} 2{,}0 & 13\cdot00 \\ 12 & 2\cdot65 \\ & \cdot2208\dot{3} \end{array}$$

4 lbs. 2 scr. = 1154 scr.,

1 oz. = 24 scr.;

therefore fraction $= \frac{1154}{24} = \frac{577}{12} = 48\cdot08\dot{3}.$

13.
$$\begin{array}{r|l} 28\left\{\begin{matrix}4\\7\end{matrix}\right. & \begin{matrix}21\cdot00\\5\cdot25\end{matrix} \\ 4 & 2\cdot75 \\ 2{,}0 & \cdot6875 \\ & \cdot034375 \end{array}$$

$$\begin{array}{r|l} 16\left\{\begin{matrix}4\\4\end{matrix}\right. & \begin{matrix}3\cdot00\\\cdot75\end{matrix} \\ 28\left\{\begin{matrix}4\\7\end{matrix}\right. & \begin{matrix}\cdot1875\\\cdot046875\end{matrix} \\ 4 & \cdot006696\dot{4}2857\dot{1}428\ldots \\ 10 & 3\cdot00167410714285\overline{7} \\ & \cdot300167410714285\overline{7} \end{array}$$

14.
$$\begin{array}{r|l} 5\frac{1}{2} & 41 \\ 2 & 2 \\ \hline 11 & 82\cdot00 \\ 4{,}0 & 7\cdot\dot{4}\dot{5} \\ 8 & 2\cdot181\dot{6}\dot{3} \\ & \cdot272295\dot{4}\dot{5} \end{array}$$

$$\begin{array}{r|l} 4{,}0 & 30\cdot0 \\ 8 & 1\cdot75 \\ 3 & \cdot21875 \\ & \cdot07291\dot{6} \end{array}$$

15.
$$\begin{array}{rr|l} & 12 & 73{\cdot}000 \\ \cline{3-3} 144 & 12 & 6{\cdot}08\dot{3} \\ \cline{3-3} & 9 & 2{\cdot}5069\dot{4} \\ \cline{3-3} & & {\cdot}2785\dot{4}93827160 \end{array} \qquad \begin{array}{r|l} 4,0 & 20{\cdot}0 \\ \cline{2-2} 4 & 3{\cdot}5 \\ \cline{2-2} & {\cdot}875 \end{array}$$

16.
$$\begin{array}{rr|l} & 4 & 2{\cdot}0 \\ \cline{3-3} 36 & \begin{cases}4\\9\end{cases} & \begin{array}{l}14{\cdot}5\\ \hline 3.625\end{array} \\ \cline{3-3} & & {\cdot}402\dot{7} \end{array} \qquad \begin{array}{r|l} 4 & 3{\cdot}00 \\ \cline{2-2} 8 & {\cdot}75 \\ \cline{2-2} 5 & 3{\cdot}09375 \\ \cline{2-2} & {\cdot}61875 \end{array}$$

17.
$$\begin{array}{rr|l} 28 & \begin{cases}4\\6\end{cases} & \begin{array}{l}18{\cdot}0\\ \hline 4{\cdot}5\end{array} \\ \cline{3-3} & 7 & 4{\cdot}75 \\ \cline{3-3} & & {\cdot}67\dot{8}5714\dot{2} \end{array} \qquad \begin{array}{rr|l} & 6,0 & 11{\cdot}0 \\ \cline{3-3} & 6,0 & {\cdot}18\dot{3} \\ \cline{3-3} 24 & \begin{cases}4\\6\end{cases} & \begin{array}{l}{\cdot}0305\dot{5}\\ \hline {\cdot}00763\dot{8}8\end{array} \\ \cline{3-3} & 5 & {\cdot}001273\dot{1}4\dot{8} \\ \cline{3-3} & & {\cdot}0002546\dot{2}9\dot{6} \end{array}$$

18. $1\frac{1}{3}$ guineas $= 28s.$ and £$1\frac{1}{2} = 30s.$,

therefore fraction $= \frac{28}{30} = \frac{2{\cdot}8}{3} = {\cdot}9\dot{3}$;

1 lb. Troy $= 5760$ grs. and 1 lb. Av. $= 7000$ grs.,

therefore fraction $= \frac{5760}{7000} = \frac{5{\cdot}76}{7} = {\cdot}82\dot{2}8571\dot{4}$.

19. $2\frac{1}{8}$ inches $= \frac{17}{8}$ in.,

$2\frac{1}{5}$ miles $= (\frac{11}{5} \times 1760 \times 3 \times 12)$ inches,

$= (11 \times 352 \times 3 \times 12)$ inches;

therefore fraction $= \frac{17}{8 \times 11 \times 352 \times 3 \times 12} = \frac{17}{1115136} = {\cdot}000015\ldots\ldots$

1 st. $6\frac{1}{2}$ lbs. $= 20\frac{1}{2}$ lbs $= \frac{41}{2}$ lbs., and $3\frac{1}{2}$ lbs. $= \frac{7}{2}$ lbs.

therefore fraction $= \frac{41}{7} = 5{\cdot}\dot{8}5714\dot{2}$.

20. $3\frac{3}{4}$ pks. $= \frac{15}{4}$ pks. and $3\frac{1}{2}$ qrs. $= (7 \times 16)$ pks.;

therefore fraction $= \frac{15}{4 \times 7 \times 16} = \frac{3{\cdot}75}{7 \times 16} = \frac{{\cdot}9375}{7 \times 4}$

$= \frac{{\cdot}234375}{7} = {\cdot}033482\dot{1}4285\dot{7}$;

$27\frac{1}{2}$ galls. $= 110$ qts. and $1\frac{1}{3}$ qts. $= \frac{4}{3}$ qts.;

therefore fraction $= \frac{110 \times 3}{4} = \frac{330}{4} = 82{\cdot}5$.

21. $5\frac{3}{4}$ yds. $= 23$ qrs., and 2 F. ells $= 12$ qrs.,

therefore fraction $= \frac{23}{12} = 1\cdot91\dot{6}$;

1 ton $2\frac{1}{4}$ cwt. $= 22\frac{1}{4}$ cwt. $= 89$ qrs., and 1 cwt. $2\frac{1}{4}$ qrs. $= \frac{25}{4}$ qrs.,

therefore fraction $= \dfrac{89 \times 4}{25} = \dfrac{356}{25} = \dfrac{71\cdot2}{5} = 14\cdot24$.

22. 3 wks. $5\frac{1}{4}$ d. $= 26\frac{1}{4}$ d. $= 630$ hrs., and $5\frac{1}{2}$ hrs. $= \frac{11}{2}$ hrs.,

therefore fraction $= \dfrac{630 \times 2}{11} = \dfrac{1260}{11} = 114\cdot\dot{5}\dot{4}$;

1 min. $2\frac{1}{4}$ sec. $= 62\frac{1}{4}$ sec. $= \frac{249}{4}$ sec.,

$\frac{1}{25}$ of a lun. month $= (\frac{1}{25} \times 29\frac{1}{2} \times 24 \times 60 \times 60)$ sec.

$= (29\frac{1}{2} \times 24 \times 12 \times 12)$ sec.,

therefore fraction $= \dfrac{249}{4 \times 59 \times 12 \times 144} = \dfrac{249}{407808} = \cdot00061 \ldots.$

23. 3 reams $= (3 \times 20 \times 24)$ sheets $= 1440$ sheets;

therefore fraction $= \frac{1440}{19} = 75\cdot789 \ldots\ldots$

$3\frac{1}{2}$ acres $= (\frac{7}{2} \times 4 \times 40 \times 30\frac{1}{4})$ sq. yds. $= (7 \times 20 \times 121)$ sq. yds.;

therefore fraction $= \dfrac{7 \times 20 \times 121}{\dfrac{13}{4}} = \dfrac{7 \times 80 \times 121}{13}$

$= \dfrac{67760}{13} = 5212\cdot\dot{3}0769\dot{2}$.

24.

$$1760\left\{\begin{array}{r|l} 10 & 33 \\ 4 & 3\cdot3 \\ 4 & \cdot825 \\ 11 & \cdot20625 \\ \hline & \cdot01875 \end{array}\right.$$

3*s.* $5\frac{11}{200}$*d.* $= 41\frac{11}{200}$*d.* $= \frac{8211}{200}$*d.*; 4*s.* 3*d.* $= 51$*d.*,

therefore fraction $= \dfrac{8211}{200 \times 51} = \dfrac{161}{200} = \cdot805$,

7*s.* $8\frac{1942}{10000}$*d.* $= 92\frac{1942}{10000}$*d.* $= \frac{921942}{10000}$*d.*; 10*s.* 6*d.* $= 126$*d.*;

therefore fraction $= \dfrac{921942}{126 \times 10000} = \dfrac{7317}{10000} = \cdot7317$.

(2) 1. $\frac{2}{3}$ of 13*s.* 6*d.* $= 9$*s.* and £1 $= 20$*s.*,

therefore fraction $= \dfrac{9}{20} = \cdot45$;

$\frac{6}{7}$ of $2\frac{1}{2}$*s.* $= \dfrac{15}{7}$*s.*,

therefore fraction $= \dfrac{15}{7} = 2\cdot\dot{1}4285\dot{7}$.

2. $\frac{5}{8}$ of a crown $=\frac{8}{5\times 5}$ *s.*,

therefore fraction $=\frac{25}{8\times 21}=\frac{3\cdot 125}{21}=\frac{1\cdot 041\dot{6}}{7}=\cdot 14\dot{8}0952\dot{3}$;

$$\begin{array}{r|l} 3 & \underline{2\cdot 0} \\ 2{,}0 & \underline{6\cdot 6\dot{6}} \\ & \cdot 3\dot{3} \end{array}$$

3. $\frac{15}{56}$ of a guinea $=\frac{15\times 21}{56}$ *s.*,

therefore fraction $=\frac{15\times 21}{56\times 20}=\frac{9}{8\times 4}=\frac{1\cdot 125}{4}=\cdot 28125$;

2 qrs. $=(2\times 8\times 4)$ pks.,

therefore fraction $=\frac{7}{8\times 2\times 8\times 4}=\frac{\cdot 875}{8\times 8}=\frac{\cdot 109375}{8}=\cdot 013671875$.

4. $\frac{3}{7}$ of a guinea $=9$*s.* and £2 $=40$*s.*,

therefore fraction $=\frac{9}{40}=\cdot 225$;

$\frac{21}{15000}$ of a year $=\frac{21\times 365}{15000}$ days,

therefore fraction $=\frac{7\times 73}{1000}=\cdot 511$.

5. $\frac{3}{7}$ of $\frac{1}{10}$ of 40 yds. $=\frac{3\times 40}{7\times 10}$ yds. $=\frac{12}{7}$ yds.;

$\frac{1}{5}$ of 2 miles $=\frac{1760\times 2}{5}$ yds. $=(352\times 2)$ yds.,

therefore fraction $=\frac{12}{7\times 352\times 2}=\frac{3}{7\times 88\times 2}=\frac{3}{1232}=\cdot 00243\ldots$;

$\frac{1}{4}$ of $3\frac{1}{2}$ sq. yds. $=\left(\frac{1}{4}\times\frac{7}{2}\right)$ sq. yds. $=\frac{7}{8}$ sq. yds.;

2 ac. 1 ro. $=9$ ro. $=(9\times 40\times 30\frac{1}{4})$ sq. yds. $=(9\times 10\times 121)$ sq. yds.,

therefore fraction $=\frac{7}{8\times 9\times 10\times 121}=\frac{7}{87120}=\cdot 000080\ldots$

6. $\frac{3}{5}$ of $4\frac{4}{9}$ hrs. $=\frac{3\times 40}{5\times 9}$ hrs. $=\frac{8}{3}$ hrs.;

$365\frac{1}{4}$ days $=\frac{1461\times 24}{4}$ hrs. $=(1461\times 6)$ hrs.,

therefore fraction $=\frac{8}{3\times 1461\times 6}=\frac{4}{13149}=\cdot 000304\ldots$,

$9\frac{6}{11}$ of $\frac{11}{15}$ pks. $= \frac{105 \times 11}{11 \times 15}$ pks. $= 7$ pks.;

$3\frac{1}{3}$ qrs. $= \left(\frac{10}{3} \times 8 \times 4\right)$ pks. $= \frac{320}{3}$ pks.;

therefore fraction $= \frac{21}{320} = \frac{2 \cdot 625}{40} = \cdot 065625.$

7. 3 lbs. 6 oz. Troy $= 42$ oz. $= (42 \times 20 \times 24)$ grs.;

10 lbs. Av. $= (10 \times 7000)$ grs.,

therefore fraction $= \frac{42 \times 20 \times 24}{10 \times 7000} = \frac{6 \times 20 \times 24}{10000} = \frac{2880}{10000} = \cdot 288;$

$\frac{1}{5}$ oz. Av. $= \left(\frac{1}{5} \times \frac{1}{16} \times 7000\right)$ grs. $= \frac{175}{2}$ grs.;

$\frac{1}{3}$ oz. Troy $= \left(\frac{1}{3} \times 20 \times 24\right)$ grs. $= 160$ grs.;

therefore fraction $= \frac{175}{2 \times 160} = \frac{21 \cdot 875}{40} = \cdot 546875.$

(3) $\frac{3}{8}$ of a crown $+ \frac{4}{5}$ of a shilling $= \left(\frac{15}{8} + \frac{4}{5}\right)$ s. $= \frac{107}{40}$ s.;

therefore fraction $= \frac{107}{40 \times 7} = \frac{2 \cdot 675}{7} = \cdot 382\dot{1}4285\dot{7}.$

(4) $\frac{3}{5}$ of a half-crown $+ \cdot 4$s. $= \left(\frac{3}{2} + \frac{2}{5}\right)$ s. $= \frac{19}{10}$ s.;

therefore fraction $= \frac{1 \cdot 9}{40} = \cdot 0475.$

(5) $\frac{3}{5}$ day $+ \frac{2}{3}$ hour $+ \frac{4}{5}$ of 6 hours $= \left(\frac{3 \times 24}{5} + \frac{2}{3} + \frac{24}{5}\right)$ hours $= \frac{298}{15}$ hours,

and 1 week $= 7 \times 24$ hours;

therefore fraction $= \frac{298}{15 \times 24 \times 7} = \frac{29 \cdot 8}{3 \times 12 \times 7} = \frac{\cdot 827777}{7} = \cdot 11\dot{8}2539\dot{6}.$

(6) $\frac{2}{5}$ guinea $- \frac{3}{4}$ of 7s. 6d. $= \left(\frac{42}{5} - \frac{45}{8}\right)$ s. $= \frac{111}{40}$ s.;

therefore fraction $= \frac{111}{27 \times 40} = \frac{37}{9 \times 40} = \frac{\cdot 925}{9} = \cdot 102\dot{7}.$

(7) $\cdot 8\dot{3}$ of 8*s.* + $\cdot\dot{0}\dot{5}$ of 2 guineas + 1·8 of 5*s.*

$$=\left(\frac{75\times 8}{90}+\frac{5\times 42}{99}+9\right)s.=\left(\frac{20}{3}+\frac{70}{33}+9\right)s.=\frac{587}{33}\,s.,$$

and half-a-guinea $=\frac{21}{2}\,s.$;

therefore fraction $=\frac{587\times 2}{21\times 33}=\frac{1174}{693}=1\cdot694\ldots.$

(8) $6\frac{1}{2}$ half-guineas = £3. 3*s.* + 5*s.* 3*d.* = £3. 8*s.* 3*d.*,

£3·525 = £3 + 10·5*s.* = £3. 10*s.* 6*d.*;

therefore difference = 2*s.* 3*d.* = 27*d.*,

and a crown = 60*d.*,

therefore fraction $=\frac{27}{60}=\frac{9}{20}=\cdot45.$

(9) $5\frac{1}{2}$ cwt. = 22 qrs.,

therefore 22 qrs. + 3·125 qrs. = 25·125 qrs.;

and a ton = (20 × 4) qrs.,

therefore fraction $=\frac{25\cdot125}{20\times 4}=\frac{2\cdot5125}{8}=\cdot3140625.$

(10) 1.

$$\begin{array}{r|l} 12 & \underline{6\cdot0} \\ 2,0 & \underline{\cdot50} \\ & \cdot025 \end{array}$$

and $\overset{c.}{2}\ .\ \overset{m.}{5}=\overset{£}{\cdot025}$

$$\begin{array}{r} \cdot025 \\ \underline{20} \\ \cdot500\,s. \\ \underline{12} \\ 6\cdot000\,d. \end{array}$$

∴ 6*d.* = 2 c. 5 m.

2.

$$\begin{array}{r|l} 12 & \underline{10\cdot0} \\ 2,0 & \underline{\cdot83\dot{3}} \\ & \cdot041\dot{6} \end{array}$$

and $\overset{c.}{4}\ .\ \overset{m.}{1\frac{2}{3}}=\overset{£}{\cdot041\dot{6}}$

$$\begin{array}{r} \cdot041\dot{6} \\ \underline{20} \\ \cdot83\dot{3}\,s. \\ \underline{12} \\ 10\cdot000\,d. \end{array}$$

∴ 10*d.* = 4 c. $1\frac{6}{9}$ m. = 4 c. $1\frac{2}{3}$ m.

3.

$$\begin{array}{r|l} 4 & \underline{2\cdot0} \\ 12 & \underline{4\cdot5} \\ 2,0 & \underline{\cdot375} \\ & \cdot01875 \end{array}$$

and $\overset{c.}{1}\ .\ \overset{m.}{8\frac{1}{4}}=\overset{£}{\cdot01875}$

$$\begin{array}{r} \cdot01875 \\ \underline{20} \\ \cdot37500\,s. \\ \underline{12} \\ 4\cdot50000\,d. \\ \underline{4} \\ 2\cdot00000\,q. \end{array}$$

∴ $4\frac{1}{2}d.$ = 1 c. $8\frac{3}{4}$ m.

4. $\begin{array}{r|l} 2,0 & 5\cdot0 \\ \cline{2-2} & \cdot25 \end{array}$

∴ 5*s.* = 2 fl. 5 c.

$$\begin{array}{r} \text{fl.}\quad \text{c.}\quad \pounds \\ \text{and } 2\ .\ 5 = \cdot25 \\ 20 \\ \hline 5\cdot00\,s. \end{array}$$

5. $\begin{array}{r|l} 12 & 6\cdot0 \\ \cline{2-2} 2,0 & 10\cdot5 \\ \cline{2-2} & \cdot525 \end{array}$

∴ 10*s.* 6*d.* = 5 fl. 2 c. 5 m.

$$\begin{array}{r} \text{fl.}\quad \text{c.}\quad \text{m.}\quad \pounds \\ \text{and } 5\ .\ 2\ .\ 5 = \cdot525 \\ 20 \\ \hline 10\cdot500\,s. \\ 12 \\ \hline 6\cdot000\,d. \end{array}$$

6. $\begin{array}{r|l} 2,0 & 16\cdot0 \\ \cline{2-2} & \cdot8 \end{array}$

∴ 16*s.* = 8 fl.

$$\begin{array}{r} \text{fl.}\quad \pounds \\ \text{and } 8 = \cdot8 \\ 20 \\ \hline 16\cdot0\,s. \end{array}$$

7. $\begin{array}{r|l} 12 & 6\cdot0 \\ \cline{2-2} 2,0 & 12\cdot5 \\ \cline{2-2} & 5\cdot625 \end{array}$

∴ £5. 12*s.* 6*d.* = £5. 6 f. 2 c. 5 m.

$$\begin{array}{r} \pounds\quad \text{f.}\quad \text{c.}\quad \text{m.}\quad \pounds \\ \text{and } 5\ .\ 6\ .\ 2\ .\ 5 = 5\cdot625 \\ 20 \\ \hline 12\cdot500\,s. \\ 12 \\ \hline 6\cdot000\,d. \end{array}$$

8. $\begin{array}{r|l} 12 & 4\cdot0 \\ \cline{2-2} 2,0 & 7\cdot3\dot{3} \\ \cline{2-2} & 54\cdot366\dot{6} \end{array}$

∴ £54. 7*s.* 4*d.* = £54. 3⅔ f.

$$\begin{array}{r} \pounds\quad \text{f.}\quad \pounds \\ \text{and } 54\ .\ 3\tfrac{2}{3} = 54\cdot3\dot{6} \\ 20 \\ \hline 7\cdot\dot{3}\,s. \\ 12 \\ \hline 4\cdot0\,d. \end{array}$$

9. $\begin{array}{r|l} 4 & 2\cdot0 \\ \cline{2-2} 12 & 7\cdot5 \\ \cline{2-2} 2,0 & 19\cdot625 \\ \cline{2-2} & 20\cdot98125 \end{array}$

∴ £20. 19*s.* 7½*d.* = £20. 9 f. 8 c. 1¼ m.

$$\begin{array}{r} \pounds\quad \text{f.}\quad \text{c.}\quad \text{m.}\quad \pounds \\ \text{and } 20\ .\ 9\ .\ 8\ .\ 1\tfrac{1}{4} = 20\cdot98125 \\ 20 \\ \hline 19\cdot62500\,s. \\ 12 \\ \hline 7\cdot50000\,d. \\ 4 \\ \hline 2\cdot00000\,q. \end{array}$$

10. $\begin{array}{r|l} 4 & 3\cdot00 \\ \cline{2-2} 12 & 4\cdot75 \\ \cline{2-2} 2,0 & 15\cdot3958\dot{3} \\ \cline{2-2} & \cdot769791\dot{6} \end{array}$

$$\begin{array}{r} \text{f.}\quad \text{c.}\quad \text{m.}\quad \pounds \\ \text{and } 7\ .\ 6\ .\ 9\cdot791\dot{6} = \cdot769791\dot{6} \\ 20 \\ \hline 15\cdot395833\dot{3}\,s. \\ 12 \\ \hline 4\cdot750000\,d. \\ 4 \\ \hline 3\cdot000000\,q. \end{array}$$

∴ 15*s.* 4¾*d.* = 7 f. 6 c. 9·791$\dot{6}$ m.

11.

$$\begin{array}{r|l} 12 & 8\cdot16 \\ \hline 2{,}0 & 14\cdot68 \\ \hline & \cdot734 \end{array} \qquad \begin{array}{l} \quad\;\; \text{f.} \;\; \text{c.} \;\; \text{m.} \qquad\; £ \\ \text{and } 7 \,.\, 3 \,.\, 4 = \;\cdot734 \\ \qquad\qquad\qquad\quad\; 20 \\ \hline \qquad\qquad\quad 14\cdot680\,s. \\ \qquad\qquad\qquad\quad\; 12 \\ \hline \qquad\qquad\quad\;\; 8\cdot160\,d. \end{array}$$

∴ 14*s.* 8·16*d.*=7 f. 3 c. 4m.

12.

$$\begin{array}{r|l} 12 & 11\cdot088 \\ \hline 2{,}0 & 15\cdot924 \\ \hline & 2\cdot7962 \end{array} \qquad \begin{array}{l} \quad\;\; £ \;\; \text{f.} \;\; \text{c.} \;\; \text{m.} \qquad\; £ \\ \text{and } 2 \,.\, 7 \,.\, 9 \,.\, 6\tfrac{1}{5} = \;2\cdot7962 \\ \qquad\qquad\qquad\qquad\quad\; 20 \\ \hline \qquad\qquad\qquad\quad 15\cdot924\,s. \\ \qquad\qquad\qquad\qquad\quad\; 12 \\ \hline \qquad\qquad\qquad\quad 11\cdot088\,d. \end{array}$$

∴ £2. 15*s.* 11·088*d.*=£2. 7 f. 9 c. 6⅕ m.

13.

$$\begin{array}{r|l} 4 & 3\cdot04 \\ \hline 12 & 11\cdot76 \\ \hline 2{,}0 & \cdot98 \\ \hline & 3\cdot049 \end{array} \qquad \begin{array}{l} \quad\;\; £ \;\; \text{c.} \;\; \text{m.} \qquad\; £ \\ \text{and } 3 \,.\, 4 \,.\, 9 = \;3\cdot049 \\ \qquad\qquad\qquad\quad\; 20 \\ \hline \qquad\qquad\quad\;\; \cdot980\,s. \\ \qquad\qquad\qquad\quad\; 12 \\ \hline \qquad\qquad\quad 11\cdot760\,d. \\ \qquad\qquad\qquad\quad\;\; 4 \\ \hline \qquad\qquad\quad\;\; 3\cdot040\,q. \end{array}$$

∴ £3. 0*s.* 11*d.* 3·04*q.*=£3. 4 c. 9 m.

Ex. LIII. (p. 160.)

1.

	£	*s.*	*d.*	
2*s.* 6*d.*=⅛ of £1	645	0	0	=value at £1 each.
	£80	12	6	=value at 2*s.* 6*d.* each.

	£	*s.*	*d.*	
10*s.*=½ of £1	69	0	0	=value at £1 each.
6*d.*=$\frac{1}{20}$ of 10*s.*	34	10	0	=value at 10*s.* each.
	1	14	6	=value at 6*d.* each.
	£36	4	6	=value at 10*s.* 6*d.* each.

2.

	£	*s.*	*d.*	
2*s.*=$\frac{1}{10}$ of £1	454	0	0	=value at £1 each.
6*d.*=¼ of 2*s.*	45	8	0	=value at 2*s.* each.
3*d.*=½ of 6*d.*	11	7	0	=value at 6*d.* each.
	5	13	6	=value at 3*d.* each.
	£62	8	6	=value at 2*s.* 9*d.* each.

	£	*s.*	*d.*	
1*s.*=$\frac{1}{20}$ of £1	72	0	0	=value at £1 each.
6*d.*=½ of 1*s.*	3	12	0	=value at 1*s.* each.
1*d.*=⅙ of 6*d.*	1	16	0	=value at 6*d.* each.
		6	0	=value at 1*d.* each.
	£5	14	0	=value at 1*s.* 7*d.* each.

		£	*s.*	*d.*	
3.	2*s.* 6*d.* = $\frac{1}{8}$ of £1	52	0	0	= value at £1 each.
	1*s.* 3*d.* = $\frac{1}{2}$ of 2*s.* 6*d.*	6	10	0	= value at 2*s.* 6*d.* each.
		3	5	0	= value at 1*s.* 3*d.* each.
		£9	15	0	= value at 3*s.* 9*d.* each.

	£	*s.*	*d.*	
6*d.* = $\frac{1}{40}$ of £1	1257	0	0	= value at £1 each.
¾*d.* = $\frac{1}{8}$ of 6*d.*	31	8	6	= value at 6*d.* each.
	3	18	6¾	= value at ¾*d.* each.
	£35	7	0¾	= value at 6¾*d.* each.

		£	*s.*	*d.*	
4.	4*s.* = $\frac{1}{5}$ of £1	626	0	0	= value at £1 each.
	4*s.* = $\frac{1}{5}$ of £1	125	4	0	= value at 4*s.* each.
	8*d.* = $\frac{1}{6}$ of 4*s.*	125	4	0	= value at 4*s.* each.
		20	17	4	= value at 8*d.* each.
		£271	5	4	= value at 8*s.* 8*d.* each.

	£	*s.*	*d.*	
10*s.* = $\frac{1}{2}$ of £1	286	0	0	= value at £1 each.
2*s.* = $\frac{1}{5}$ of 10*s.*	143	0	0	= value at 10*s.* each.
1*d.* = $\frac{1}{24}$ of 2*s.*	28	12	0	= value at 2*s.* each.
	1	3	10	= value at 1*d.* each.
	£172	15	10	= value at 12*s.* 1*d.* each.

		£	*s.*	*d.*	
5.	4*s.* = $\frac{1}{5}$ of £1	80	0	0	= value at £1 each.
	4*d.* = $\frac{1}{12}$ of 4*s.*	16	0	0	= value at 4*s.* each.
	¼*d.* = $\frac{1}{16}$ of 4*d.*	1	6	8	= value at 4*d.* each.
			1	8	= value at ¼*d.* each.
		£17	8	4	= value at 4*s.* 4¼*d.* each.

	£	*s.*	*d.*	
4*s.* = $\frac{1}{5}$ of £1	37	0	0	= value at £1 each.
1*s.* = $\frac{1}{4}$ of 4*s.*	7	8	0	= value at 4*s.* each.
4*d.* = $\frac{1}{3}$ of 1*s.*	1	17	0	= value at 1*s.* each.
1*d.* = $\frac{1}{4}$ of 4*d.*		12	4	= value at 4*d.* each.
½*d.* = $\frac{1}{2}$ of 1*d.*		3	1	= value at 1*d.* each.
		1	6½	= value at ½*d.* each.
	£10	1	11½	= value at 5*s.* 5½*d.* each.

		£	*s.*	*d.*	
6.	10*s.* = $\frac{1}{2}$ of £1	138	0	0	= value at £1 each.
	4*s.* = $\frac{1}{5}$ of £1	69	0	0	= value at 10*s.* each.
		27	12	0	= value at 4*s.* each.
		£234	12	0	= value at £1. 14*s.* each.

		£	s.	d.	
	10s. = $\frac{1}{2}$ of £1	589	0	0	= value at £1 each.
	1s. = $\frac{1}{10}$ of 10s.	294	10	0	= value at 10s. each.
	6d. = $\frac{1}{2}$ of 1s.	29	9	0	= value at 1s. each.
		14	14	6	= value at 6d. each.
		£927	13	6	= value at £1. 11s. 6d. each.

		£	s.	d.	
7.	2s. 6d. = $\frac{1}{8}$ of £1	95	0	0	= value at £1 each
		11	17	6	= value at 2s 6d. each.
		£106	17	6	= value at £1. 2s. 6d. each.

		£	s.	d.	
	5s. = $\frac{1}{4}$ of £1	107	0	0	= value at £1 each.
				6	
		642	0	0	= value at £6 each.
				4	
		2568	0	0	= value at £24 each.
	1s. = $\frac{1}{5}$ of 5s.	26	15	0	= value at 5s. each.
	2d. = $\frac{1}{6}$ of 1s.	5	7	0	= value at 1s. each.
			17	10	= value at 2d. each.
		£2600	19	10	= value at £24. 6s. 2d. each.

		£	s.	d.	
8.	4s. = $\frac{1}{5}$ of £1	457	0	0	= value at £1 each.
	4s. = $\frac{1}{5}$ of £1	91	8	0	= value at 4s. each.
	6d. = $\frac{1}{8}$ of 4s.	91	8	0	= value at 4s. each.
		11	8	6	= value at 6d. each.
		£651	4	6	= value at £1. 8s. 6d. each.

		£	s.	d.	
	1s. = $\frac{1}{20}$ of £1	88	0	0	= value at £1 each.
	1½d. = $\frac{1}{8}$ of 1s.	4	8	0	= value at 1s. each.
			11	0	= value at 1½d. each.

		£	s.	d.	
9.	5s. = $\frac{1}{4}$ of £1	111	0	0	= value at £1 each.
				2	
		222	0	0	= value at £2 each.
	10d. = $\frac{1}{6}$ of 5s.	27	15	0	= value at 5s. each.
		4	12	6	= value at 10d. each.
		£254	7	6	= value at £2. 5s. 10d. each.

		£	s.	d.	
	10s. = $\frac{1}{2}$ of £1	9251	0	0	= value at £1 each.
	4s. = $\frac{1}{5}$ of £1	4625	10	0	= value at 10s. each.
	8d. = $\frac{1}{6}$ of 4s.	1850	4	0	= value at 4s. each.
	2d. = $\frac{1}{4}$ of 8d.	308	7	4	= value at 8d. each.
	1d. = $\frac{1}{2}$ of 2d.	77	1	10	= value at 2d. each.
		38	10	11	= value at 1d. each.
		£6899	14	1	= value at 14s. 11d. each.

10.

	s.	d.	
6*d.* = ½ of 1*s.*	4681	0	= value at 1*s.* each.
2*d.* = ⅓ of 6*d.*	2340	6	= value at 6*d.* each.
¾*d.* = ⅛ of 6*d.*	780	2	= value at 2*d.* each.
	292	6¾	= value at ¾*d.* each.
2,0	341,3	2¾	
	£170 . 13	2¾	= value at 8¾*d.* each.

	£	s.	d.	
10*s.* = ½ of £1	1209	0	0	= value at £1 each.
2*s.* 6*d.* = ¼ of 10*s.*	604	10	0	= value at 10*s.* each.
6*d.* = ⅕ of 2*s.* 6*d.*	151	2	6	= value at 2*s.* 6*d.* each.
1*d.* = ⅙ of 6*d.*	30	4	6	= value at 6*d.* each.
	5	0	9	= value at 1*d.* each.
	£790	17	9	= value at 13*s.* 1*d.* each.

11.

	£	s.	d.	
5*s.* = ¼ of £1	1450	0	0	= value at £1 each.
2*s.* = $\frac{1}{10}$ of £1	362	10	0	= value at 5*s.* each.
8*d.* = ⅓ of 2*s.*	145	0	0	= value at 2*s.* each.
	48	6	8	= value at 8*d.* each.
	£2005	16	8	= value at £1. 7*s.* 8*d.* each.

	£	s.	d.	
10*s.* = ½ of £1	249	0	0	= value at £1 each.
			2	
	498	0	0	= value at £2 each.
2*s.* 6*d.* = ¼ of 10*s.*	124	10	0	= value at 10*s.* each.
1*s.* 3*d.* = ½ of 2*s.* 6*d.*	31	2	6	= value at 2*s.* 6*d.* each.
	15	11	3	= value at 1*s.* 3*d.* each.
	£669	3	9	= value at £2. 13*s.* 9*d.* each.

12.

	£	s.	d.	
10*s.* = ½ of £1	898	0	0	= value at £1 each.
4*s.* = ⅕ of £1	449	0	0	= value at 10*s.* each.
4*s.* = ⅕ of £1	179	12	0	= value at 4*s.* each.
6*d* = ⅛ of 4*s.*	179	12	0	= value at 4*s.* each.
1*d.* = ⅙ of 6*d.*	22	9	0	= value at 6*d.* each.
¾*d.* = ⅛ of 6*d.*	3	14	10	= value at 1*d.* each.
	2	16	1½	= value at ¾*d.* each.
	£837	3	11½	= value at 18*s.* 7¾*d.* each.

	£	s.	d.	
10*s.* = ½ of £1	405	0	0	= value at £1 each.
5*s.* = ½ of 10*s.*	202	10	0	= value at 10*s.* each.
4*s.* = ⅕ of £1	101	5	0	= value at 5*s.* each.
8*d.* = ⅙ of 4*s.*	81	0	0	= value at 4*s.* each.
¼*d.* = $\frac{1}{32}$ of 8*d.*	13	10	0	= value at 8*d.* each.
		8	5¼	= value at ¼*d.* each.
	£398	13	5¼	= value at 19*s.* 8¼*d.* each.

13.

		£	s.	d.	
	1s. = $\frac{1}{20}$ of £1	744	0	0	= value at £1 each.
				20	
		14880	0	0	= value at £20 each.
	subtracting	37	4	0	= value at 1s. each.
		£14842	16	0	= value at £19. 19s. each.

	£	s.	d.	
2s. = $\frac{1}{10}$ of £1	421	0	0	= value at £1 each.
			4	
	1684	0	0	= value at £4 each.
6d. = $\frac{1}{4}$ of 2s.	42	2	0	= value at 2s. each.
$\frac{3}{4}$d. = $\frac{1}{8}$ of 6d.	10	10	6	= value at 6d. each.
	1	6	$3\frac{3}{4}$	= value at $\frac{3}{4}$d. each.
	£1737	18	$9\frac{3}{4}$	= value at £4. 2s. $6\frac{3}{4}$d. each.

14.

	s.	d.	
$\frac{1}{2}$d. = $\frac{1}{24}$ of 1s.	1593	0	= value at 1s. each.
		9	
	14337	0	= value at 9s. each.
	66	$4\frac{1}{2}$	= value at $\frac{1}{2}$d. each.
2,0	1440,3	$4\frac{1}{2}$	
	£720 . 3	$4\frac{1}{2}$	= value at 9s. $0\frac{1}{2}$d. each.

	s.	d.	
1d. = $\frac{1}{12}$ of 1s.	6602	0	= value at 1s. each.
		7	
	46214	0	= value at 7s. each.
$\frac{1}{2}$d. = $\frac{1}{2}$ of 1d.	550	2	= value at 1d. each.
$\frac{1}{4}$d. = $\frac{1}{2}$ of $\frac{1}{2}$d.	275	1	= value at $\frac{1}{2}$d. each.
	137	$6\frac{1}{2}$	= value at $\frac{1}{4}$d. each.
2,0	4717,6	$9\frac{1}{2}$	
	£2358 . 16	$9\frac{1}{2}$	= value at 7s. $1\frac{3}{4}$d. each.

15.

	£	s.	d.	
10s. = $\frac{1}{2}$ of £1	7382	0	0	= value at £1 each.
			3	
	22146	0	0	= value at £3 each.
5s. = $\frac{1}{2}$ of 10s.	3691	0	0	= value at 10s. each.
4d. = $\frac{1}{15}$ of 5s.	1845	10	0	= value at 5s. each.
$\frac{1}{2}$d. = $\frac{1}{8}$ of 4d.	123	0	8	= value at 4d. each.
	15	7	7	= value at $\frac{1}{2}$d. each.
	£27820	18	3	= value at £3. 15s. $4\frac{1}{2}$d. each.

	£	s.	d.	
10s. = $\frac{1}{2}$ of £1	5614	0	0	= value at £1 each.
			14	
	78596	0	0	= value at £14 each.
4s. = $\frac{1}{5}$ of £1	2807	0	0	= value at 10s. each.
4d. = $\frac{1}{12}$ of 4s.	1122	16	0	= value at 4s. each.
1d. = $\frac{1}{4}$ of 4d.	93	11	4	= value at 4d. each.
$\frac{1}{2}$d. = $\frac{1}{2}$ of 1d.	23	7	10	= value at 1d. each.
	11	3	11	= value at $\frac{1}{2}$d. each.
	£82654	9	1	= value at £14. 14s. $5\frac{1}{2}$d. each.

		£	s.	d.	
16.	10*s*. = ½ of £1	6573	0	0	= value at £1 each.
				5	
		32865	0	0	= value at £5 each.
	5*s*. = ½ of 10*s*.	3286	10	0	= value at 10*s*. each.
	2*s*. 6*d*. = ½ of 5*s*.	1643	5	0	= value at 5*s*. each.
	1*s*. = ⅕ of 5*s*.	821	12	6	= value at 2*s*. 6*d*. each.
	4*d*. = ⅓ of 1*s*.	328	13	0	= value at 1*s*. each.
	¼*d*. = 1/16 of 4*d*.	109	11	0	= value at 4*d*. each.
		6	16	11¼	= value at ¼*d*. each.
		£39061	8	5¼	= value at £5. 18*s*. 10¼*d*. each.

		£	s.	d.	
	10*s*. = ½ of £1	37271	0	0	= value at £1 each.
				6	
		223626	0	0	= value at £6 each.
	2*s*. 6*d*. = ¼ of 10*s*.	18635	10	0	= value at 10*s*. each.
	6*d*. = ⅕ of 2*s*. 6*d*.	4658	17	6	= value at 2*s*. 6*d*. each.
	¾*d*. = ⅛ of 6*d*.	931	15	6	= value at 6*d*. each.
		116	9	5¼	= value at ¾*d*. each.
		£247968	12	5¼	= value at £6. 13*s*. 0¾*d*. each.

		£	s.	d.	
17.	10*s*. = ½ of £1	51143	0	0	= value at £1 each.
				4	
		204572	0	0	= value at £4 each.
	5*s*. = ½ of 10*s*.	25571	10	0	= value at 10*s*. each.
	2*s*. 6*d*. = ½ of 5*s*.	12785	15	0	= value at 5*s*. each.
	3*d*. = 1/10 of 2*s*. 6*d*.	6392	17	6	= value at 2*s*. 6*d*. each.
	¼*d*. = 1/12 of 3*d*.	639	5	9	= value at 3*d*. each.
		53	5	5¾	= value at ¼*d*. each.
		£250014	13	8¾	= value at £4. 17*s*. 9¼*d*. each.

		£	s.	d.	
	10*d*. = 1/24 of £1	6293	0	0	= value at £1 each.
				7	
		44051	0	0	= value at £7 each.
	1*d*. = 1/10 of 10*d*.	262	4	2	= value at 10*d*. each.
	½*d*. = ½ of 1*d*.	26	4	5	= value at 1*d*. each.
	¼*d*. = ½ of ½*d*.	13	2	2½	= value at ½*d*. each.
		6	11	1¼	= value at ¼*d*. each.
		£44359	1	10¾	= value at £7. 0*s*. 11¾*d*. each.

		£	s.	d.	
18.	10*s*. = ½ of £1	3027	0	0	= value at £1 each.
				5	
		15135	0	0	= value at £5 each.
	2*s*. = ⅕ of 10*s*.	1513	10	0	= value at 10*s*. each.
	2*d*. = 1/12 of 2*s*.	302	14	0	= value at 2*s*. each.
	½*d*. = ¼ of 2*d*.	25	4	6	= value at 2*d*. each.
		6	6	1½	= value at ½*d*. each.
		£16982	14	7½	= value at £5. 12*s*. 2½*d*. each.

	£	s.	d.	
1d. = $\frac{1}{240}$ of £1	4945	0	0	= value at £1 each.
½d. = ½ of 1d.	20	12	1	= value at 1d. each.
¼d. = ½ of ½d.	10	6	0½	= value at ½d. each.
	5	3	0¼	= value at ¼d. each.
	£4981	1	1¾	= value at £1. 0s. 1¾d. each.

19.

	£	s.	d.	
5s. = ¼ of £1	733	0	0	= value at £1 each.
4s. = $\frac{1}{5}$ of £1	183	5	0	= value at 5s. each.
4d. = $\frac{1}{12}$ of 4s.	146	12	0	= value at 4s. each.
	12	4	4	= value at 4d. each.
	1075	1	4	= value at £1. 9s. 4d. each.
¼ of £1. 9s. 4d. =		7	4	
	£1075	8	8	= value of 733¼.

	£	s.	d.	
10s. = ½ of £1	751	0	0	= value at £1 each.
			2	
	1502	0	0	= value at £2 each.
5s. = ½ of 10s.	375	10	0	= value at 10s. each.
2s. 6d. = ½ of 5s.	187	15	0	= value at 5s. each.
3d. = $\frac{1}{10}$ of 2s. 6d.	93	17	0	= value at 2s. 6d. each.
1d. = ⅓ of 3d.	9	7	9	= value at 3d. each.
	3	2	7	= value at 1d. each.
	2171	12	10	= value at £2. 17s. 10d. each.
½ of £2. 17s. 10d. =	1	8	11	
	£2173	1	9	= value of 751½.

20.

		s.	d.	
6d. = ½ of 1s.		1418	0	= value at 1s. each.
			7	
		9926	0	= value at 7s. each.
3d. = ½ of 6d.		709	0	= value at 6d. each.
½d. = ⅙ of 3d.		354	6	= value at 3d. each.
		59	1	= value at ½d. each.
	2,0)	11048	7	
	£552	8	7	= value at 7s. 9½d. each.
¾ of 7s. 9½d. =		5	10—½q.	
	£552	14	5—½q.	= value of 1418¾.

	£	s.	d.	
10s. = ½ of £1	1178	0	0	= value at £1 each.
5s. = ½ of 10s.	589	0	0	= value at 10s. each.
1s. 8d. = ⅓ of 5s.	294	10	0	= value at 5s. each.
	98	3	4	= value at 1s. 8d. each.
	981	13	4	= value at 16s. 8d. each.
⅜ of 16s. 8d. =		6	3	
	£981	19	7	= value of 1178⅜.

		£	*s.*	*d.*	
21.	1*s.* = $\frac{1}{20}$ of £1	1762	0	0	= value at £1 each.
	6*d.* = $\frac{1}{2}$ of 1*s.*	88	2	0	= value at 1*s.* each.
	4*d.* = $\frac{1}{3}$ of 1*s.*	44	1	0	= value at 6*d.* each.
	$\frac{1}{2}$*d.* = $\frac{1}{8}$ of 4*d.*	29	7	4	= value at 4*d.* each.
		3	13	5	= value at $\frac{1}{2}$*d.* each.
		1927	3	9	= value at £1. 1*s.* $10\frac{1}{2}$*d.* each.
	$\frac{3}{5}$ of £1. 1*s.* $10\frac{1}{2}$*d.* =		13	$1\frac{1}{2}$	
		£1927	16	$10\frac{1}{2}$	= value of $1762\frac{3}{5}$.

		s.	*d.*	
6*d.* = $\frac{1}{2}$ of 1*s.*		5555	0	= value at 1*s.* each.
			6	
		33330	0	= value at 6*s.* each.
4*d.* = $\frac{1}{3}$ of 1*s.*		2777	6	= value at 6*d.* each.
$\frac{1}{4}$*d.* = $\frac{1}{16}$ of 4*d.*		1851	8	= value at 4*d.* each.
		115	$8\frac{3}{4}$	= value at $\frac{1}{4}$*d.* each.
2,0		3807,4	$10\frac{3}{4}$	
	1903	14	$10\frac{3}{4}$	= value at 6*s.* $10\frac{1}{4}$*d.* each.
$\frac{5}{9}$ of 6*s.* $10\frac{1}{4}$*d.* =		3	$9\frac{25}{36}$	
	£1903	18	$8\frac{1}{4}$. $\frac{7}{9}$*q.*	= value of $5555\frac{5}{9}$.

		£	*s.*	*d.*	
22.	10*s.* = $\frac{1}{2}$ of £1	4013	0	0	= value at £1 each.
				2	
		8026	0	0	= value at £2 each.
	5*s.* = $\frac{1}{2}$ of 10*s.*	2006	10	0	= value at 10*s.* each.
	1*s.* = $\frac{1}{5}$ of 5*s.*	1003	5	0	= value at 5*s.* each.
	6*d.* = $\frac{1}{2}$ of 1*s.*	200	13	0	= value at 1*s.* each.
	$\frac{1}{4}$*d.* = $\frac{1}{24}$ of 6*d.*	100	6	6	= value at 6*d.* each.
		4	3	$7\frac{1}{4}$	= value at $\frac{1}{4}$*d.* each.
		11340	18	$1\frac{1}{4}$	= value at £2. 16*s.* $6\frac{1}{4}$*d.*
	$\frac{5}{8}$ of £2. 16*s.* $6\frac{1}{4}$*d.* =	1	15	$3\frac{3}{4}$. $\frac{5}{8}$*q.*	
		£11342	13	5 — $\frac{5}{8}$*q.*	= value of $4013\frac{5}{8}$ at £2. 16*s.* $6\frac{1}{4}$*d.* each.

	£	*s.*	*d.*	
10*s.* = $\frac{1}{2}$ of £1	6005	0	0	= value at £1 each.
5*s.* = $\frac{1}{2}$ of 10*s.*	3002	10	0	= value at 10*s.* each.
2*s.* 6*d.* = $\frac{1}{2}$ of 5*s.*	1501	5	0	= value at 5*s.* each.
6*d.* = $\frac{1}{5}$ of 2*s.* 6*d.*	750	12	6	= value at 2*s.* 6*d.* each.
3*d.* = $\frac{1}{2}$ of 6*d.*	150	2	6	= value at 6*d.* each.
$\frac{3}{4}$*d.* = $\frac{1}{4}$ of 3*d.*	75	1	3	= value at 3*d.* each.
	18	15	$3\frac{3}{4}$	= value at $\frac{3}{4}$*d.* each.
	5498	6	$6\frac{3}{8}$	= value at 18*s.* $3\frac{3}{4}$*d.* each.
$\frac{2}{11}$ of 18*s.* $3\frac{3}{4}$*d.* =		3	$3\frac{3}{4}$. $\frac{9}{11}$*q.*	
	£5498	9	$10\frac{1}{2}$. $\frac{9}{11}$*q.*	= value of $6005\frac{2}{11}$ at 18*s.* $3\frac{3}{4}$*d.* each.

	£	*s*.	*d*.	
23. 10*s*. = $\frac{1}{2}$ of £1	6444	0	0	= value at £1 each.
			10	
	64440	0	0	= value at £10 each.
4*s*. = $\frac{1}{5}$ of £1	3222	0	0	= value at 10*s*. each.
8*d*. = $\frac{1}{6}$ of 4*s*.	1288	16	0	= value at 4*s*. each.
2*d*. = $\frac{1}{4}$ of 8*d*.	214	16	0	= value at 8*d*. each.
$\frac{1}{2}$*d*. = $\frac{1}{4}$ of 2*d*.	53	14	0	= value at 2*d*. each.
	13	8	6	= value at $\frac{1}{2}$*d*. each.
	69232	14	6	= value at £10. 14*s*. 10$\frac{1}{2}$*d*. each.
$\frac{13}{16}$ of £10. 14*s*. 10$\frac{1}{2}$*d*. =	8	14	7$\frac{1}{32}$	
	£69241	9	1$\frac{1}{32}$	= value of 6444$\frac{13}{16}$.

	£	*s*.	*d*.	
10*s*. = $\frac{1}{2}$ of £1	5109	0	0	= value at £1 each.
			4	
	20436	0	0	= value at £4 each.
5*s*. = $\frac{1}{2}$ of 10*s*.	2554	10	0	= value at 10*s*. each.
1*s*. = $\frac{1}{5}$ of 5*s*.	1277	5	0	= value at 5*s*. each.
4*d*. = $\frac{1}{3}$ of 1*s*.	255	9	0	= value at 1*s*. each.
$\frac{1}{4}$*d*. = $\frac{1}{16}$ of 4*d*.	85	3	0	= value at 4*d*. each.
	5	6	5$\frac{1}{4}$	= value at $\frac{1}{4}$*d*. each.
	24613	13	5$\frac{1}{4}$	= value at £4. 16*s*. 4$\frac{1}{4}$*d*. each.
$\frac{9}{13}$ of £4. 16*s*. 4$\frac{1}{4}$*d*. =	3	6	8$\frac{1}{4}$. $\frac{12}{13}$*q*.	
	£24617	0	1$\frac{1}{2}$. $\frac{12}{13}$*q*.	= value of 5109$\frac{9}{13}$.

24. $43 \cdot 35 = 43\frac{35}{100} = 43\frac{7}{20}$.

	s.	*d*.	
6*d*. = $\frac{1}{2}$ of 1*s*.	43	0	= value at 1*s*. each.
		8	
	344	0	= value at 8*s*. each.
4*d*. = $\frac{1}{3}$ of 1*s*.	21	6	= value at 6*d*. each.
1*d*. = $\frac{1}{4}$ of 4*d*.	14	4	= value at 4*d*. each.
$\frac{1}{4}$*d*. = $\frac{1}{4}$ of 1*d*.	3	7	= value at 1*d*. each.
		10$\frac{3}{4}$	= value at $\frac{1}{4}$*d*. each.
2,0	38,4	3$\frac{3}{4}$	
	19 . 4	3$\frac{3}{4}$	= value at 8*s*. 11$\frac{1}{4}$*d*. each.
$\frac{7}{20}$ of 8*s*. 11$\frac{1}{4}$*d*. =	3	1$\frac{1}{2}$. $\frac{3}{20}$*q*.	
	£19 . 7	5$\frac{1}{4}$. $\frac{3}{20}$*q*.	= value of 43·35 at 8*s*. 11$\frac{1}{4}$*d*. each.

$147 \cdot 625 = 147\frac{625}{1000} = 147\frac{5}{8}$.

	£	*s*.	*d*.	
10*s*. = $\frac{1}{2}$ of £1	147	0	0	= value at £1 each.
5*s*. = $\frac{1}{2}$ of 10*s*.	73	10	0	= value at 10*s*. each.
4*s*. = $\frac{1}{5}$ of £1	36	15	0	= value at 5*s*. each.
6*d*. = $\frac{1}{8}$ of 4*s*.	29	8	0	= value at 4*s*. each.
1*d*. = $\frac{1}{6}$ of 6*d*.	3	13	6	= value at 6*d*. each.
$\frac{1}{4}$*d*. = $\frac{1}{4}$ of 1*d*.		12	3	= value at 1*d*. each.
		3	0$\frac{3}{4}$	= value at $\frac{1}{4}$*d*. each.
	144	1	9$\frac{3}{4}$	= value at 19*s*. 7$\frac{1}{4}$*d*. each.
$\frac{5}{8}$ of 19*s*. 7$\frac{1}{4}$ =		12	3 . $\frac{1}{8}$*q*.	
	£144	14	0$\frac{3}{4}$. $\frac{1}{8}$*q*.	= value of 147·625.

			s.	*d.*	
25.	6*d.* = $\frac{1}{2}$ of 1*s.*		1430	0	= value at 1*s.* each.
	2*d.* = $\frac{1}{3}$ of 6*d.*		715	0	= value at 6*d.* each.
	$\frac{2}{3}$*d.* = $\frac{1}{3}$ of 2*d.*		238	4	= value at 2*d.* each.
			79	$5\frac{1}{4}$. $\frac{1}{3}q.$	= value at $\frac{2}{3}$*d.* each.
		2,0	103,2	$9\frac{1}{4}$. $\frac{1}{3}q.$	
			£51 . 12	$9\frac{1}{4}$. $\frac{1}{3}q.$	= value at $8\frac{2}{3}$*d.* each.

		s.	*d.*	
6*d.* = $\frac{1}{2}$ of 1*s.*		7866	0	= value at 1*s.* each.
			2	
		15732	0	= value at 2*s.* each.
$\frac{1}{9}$*d.* = $\frac{1}{54}$ of 6*d.*		3933	0	= value at 6*d.* each.
		72	10	= value at $\frac{1}{9}$*d.* each.
	2,0	1973,7	10	
		£986 . 17	10	= value at 2*s.* $6\frac{1}{9}$*d.* each.

		£	*s.*	*d.*	
26.	4*s.* = $\frac{1}{5}$ of £1	7400	0	0	= value at £1 each.
	6*d.* = $\frac{1}{8}$ of 4*s.*	1480	0	0	= value at 4*s.* each.
	3*d.* = $\frac{1}{2}$ of 6*d.*	185	0	0	= value at 6*d.* each.
	$\frac{7}{12}$*d.* = $\frac{7}{36}$ of 3*d.*	92	10	0	= value at 3*d.* each.
		17	19	$8\frac{1}{2}$. $\frac{2}{3}q.$	= value at $\frac{7}{12}$*d.* each.
		£1775	9	$8\frac{1}{2}$. $\frac{2}{3}q.$	= value at 4*s.* $9\frac{7}{12}$*d.* each.

	£	*s.*	*d.*	
5*s.* = $\frac{1}{4}$ of £1	2841	0	0	= value at £1 each.
10*d.* = $\frac{1}{6}$ of 5*s.*	710	5	0	= value at 5*s.* each.
$\frac{3}{14}$*d.* = $\frac{3}{140}$ of 10*d.*	118	7	6	= value at 10*d.* each.
	2	10	$8\frac{3}{4}$. $\frac{1}{7}q.$	= value at $\frac{3}{14}$*d.* each.
	£831	3	$2\frac{3}{4}$. $\frac{1}{7}q.$	= value at 5*s.* $10\frac{3}{14}$*d.* each.

		£	*s.*	*d.*	
27.	10*s.* = $\frac{1}{2}$ of £1	6352	0	0	= value at £1 each.
	2*s.* 6*d.* = $\frac{1}{4}$ of 10*s.*	3176	0	0	= value at 10*s.* each.
	1*s.* = $\frac{1}{10}$ of 10*s.*	794	0	0	= value at 2*s.* 6*d.* each.
	1*d.* = $\frac{1}{12}$ of 1*s.*	317	12	0	= value at 1*s.* each.
	$\frac{9}{10}$*d.* = $\frac{9}{10}$ of 1*d.*	26	9	4	= value at 1*d.* each.
		23	16	$4\frac{3}{4}$. $\frac{1}{5}q.$	= value at $\frac{9}{10}$*d.* each.
		£10689	17	$8\frac{3}{4}$. $\frac{1}{5}q.$	= val. at £1. 13*s.* $7\frac{9}{10}$*d.* each.

	£	*s.*	*d.*	
	2731	0	0	= value at £1 each.
			4	
8*s.* = $\frac{1}{10}$ of £4	10924	0	0	= value at £4 each.
6*d.* = $\frac{1}{16}$ of 8*s.*	1092	8	0	= value at 8*s.* each.
3*d.* = $\frac{1}{2}$ of 6*d.*	68	5	6	= value at 6*d.* each.
$\frac{2}{3}$*d.* = $\frac{2}{9}$ of 3*d.*	34	2	9	= value at 3*d.* each.
	7	11	$8\frac{1}{2}$. $\frac{2}{3}q.$	= value at $\frac{2}{3}$*d.* each.
	£12126	7	$11\frac{1}{2}$. $\frac{2}{3}q.$	= value at £4. 8*s.* $9\frac{2}{3}$*d.* each.

28.

	£	s.	d.	
2 qrs. = ½ cwt.	2	5	6	= value of 1 cwt.
			5	
	11	7	6	= value of 5 cwt.
14 lbs. = ¼ of 2 qrs.	1	2	9	= value of 2 qrs.
		5	8¼	= value of 14 lbs.
	£12	15	11¼	= value of 5 cwt. 2 qrs. 14 lbs.

29.

	£	s.	d.	
2 qrs. = ½ cwt.	6	7	8	= value of 1 cwt.
			3	
	19	3	0	= value of 3 cwt.
			11	
	210	13	0	= value of 33 cwt.
1 qr. = ½ of 2 qrs.	3	3	10	= value of 2 qrs.
7 lbs. = ¼ of 1 qr.	1	11	11	= value of 1 qr.
		7	11¾	= value of 7 lbs.
	£215	16	8¾	= value of 33 cwt. 3 qrs. 7 lbs.

30.

	£	s.	d.	
2 qrs. = ½ cwt.	1	4	6	= value of 1 cwt.
			8	
	9	16	0	= value of 8 cwt.
			9	
	88	4	0	= value of 72 cwt.
1 qr. = ½ of 2 qrs.		12	3	= value of 2 qrs.
14 lbs. = ½ of 1 qr.		6	1½	= value of 1 qr.
2 lbs. = $\frac{1}{7}$ of 14 lbs.		3	0¾	= value of 14 lbs.
1 lb. = ½ of 2 lbs.			5¼	= value of 2 lbs.
			2½ . ½*q*.	= value of 1 lb.
	£89	6	1 — ½*q*.	= value of 72 cwt. 3 qrs. 17 lbs.

31.

	£	s.	d.	
2 qrs. = ½ cwt.	7	13	6	= value of 1 cwt.
			6	
	46	1	0	= value of 6 cwt.
			10	
	460	10	0	= value of 60 cwt.
1 qr. = ½ of 2 qrs.	3	16	9	= value of 2 qrs.
7 lbs. = ¼ of 1 qr.	1	18	4½	= value of 1 qr.
4 lbs. = $\frac{1}{7}$ of 1 qr.		9	7⅛	= value of 7 lbs.
1 lb. = ¼ of 4 lbs.		5	5$\frac{11}{14}$	= value of 4 lbs.
		1	4$\frac{25}{56}$	= value of 1 lb.
	£467	1	6¾ . $\frac{3}{7}$*q*.	= value of 60cwt. 3qrs. 12lbs.

32.

	£	s.	d.	
2 qrs. = ½ cwt.	3	7	6	= value of 1 cwt.
			3	
	10	2	6	= value of 3 cwt.
14 lbs. = ¼ of 2 qrs.	1	13	9	= value of 2 qrs.
2 lbs. = $\frac{1}{7}$ of 14 lbs.		8	5¼	= value of 14 lbs.
		1	2¼ . $\frac{6}{7}$*q*.	= value of 2 lbs.
	£12	5	10½ . $\frac{6}{7}$*q*.	= value of 3 cwt. 2 qrs. 16 lbs.

		£	s.	d.	
33.	1 ft. = $\frac{1}{3}$ of 1 yard	0	5	$7\frac{1}{2}$	= value of 1 yard.
				9	
		2	10	$7\frac{1}{2}$	= value of 9 yards.
	1 ft. = $\frac{1}{3}$ of 1 yard		1	$10\frac{1}{2}$	= value of 1 foot.
	6 in. = $\frac{1}{2}$ of 1 foot		1	$10\frac{1}{2}$	= value of 1 foot.
	4 in. = $\frac{1}{3}$ of 1 foot			$11\frac{1}{4}$	= value of 6 inches.
				$7\frac{1}{2}$	= value of 4 inches.
		£2	15	$11\frac{1}{4}$	= value of 9 yds. 2 ft. 10 in.

		£	s.	d.	
34.	8 lbs. = $\frac{1}{14}$ of a cwt.	3	15	$7\frac{3}{4}$	= value of 1 cwt.
				4	
		15	2	7	= value of 4 cwt.
				10	
		151	5	10	= value of 40 cwt.
	subtracting	3	15	$7\frac{3}{4}$	= value of 1 cwt.
		147	10	$2\frac{1}{4}$	= value of 39 cwt.
	2 lbs. = $\frac{1}{4}$ of 8 lbs.		5	$4\frac{47}{56}d.$	= value of 8 lbs.
			1	$4\frac{47}{224}d.$	= value of 2 lbs.
		£147	16	$11\frac{1}{4} . \frac{11}{56}q.$	= value of 39 cwt. 10 lbs.

		£	s.	d.	
35.	14 lbs. = $\frac{1}{2}$ of 1 qr.	1	17	$8\frac{1}{4}$	= cost of 1 qr.
				12	
		22	12	3	= cost of 12 qrs.
				10	
		226	2	6	= cost of 120 qrs. or 30 cwt.
		3	15	$4\frac{1}{2}$	= cost of 2 qrs.
		229	17	$10\frac{1}{2}$	= cost of 30 cwt. 2 qrs.
			18	$10\frac{1}{8}$	= cost of 14 lbs.
		£230	16	$8\frac{1}{2} . \frac{1}{2}q.$	= cost of 30 cwt. 2 qrs. 14 lbs.

		£	s.	d.	
36.	5 dwts. = $\frac{1}{4}$ of 1 oz.	0	5	10	= value of 1 oz.
				3	
		0	17	6	= value of 3 oz.
				5	
		4	7	6	= value of 15 oz.
	1 dwt. = $\frac{1}{5}$ of 5 dwts.		1	$5\frac{1}{2}$	= value of 5 dwts.
	12 grs. = $\frac{1}{2}$ of 1 dwt.			$3\frac{1}{2}$	= value of 1 dwt.
	4 grs. = $\frac{1}{3}$ of 12 grs.			$1\frac{3}{4}$	= value of 12 grs.
	1 gr. = $\frac{1}{4}$ of 4 grs.			$\frac{7}{12}$	= value of 4 grs.
				$\frac{7}{48}$	= value of 1 gr.
		£4	9	$5\frac{1}{4} . \frac{11}{12}q.$	= val. of 15 oz. 6 dwts. 17 grs.

		£	s.	d.	
37.	2 roods $=\frac{1}{2}$ of 1 acre	2	12	6	=rent of 1 acre.
				2	
		5	5	0	=rent of 2 acres.
				10	
		52	10	0	=rent of 20 acres.
		7	17	6	=rent of 3 acres.
		60	7	6	=rent of 23 acres.
	1 rood $=\frac{1}{2}$ of 2 roods	1	6	3	=rent of 2 roods.
	5 poles $=\frac{1}{8}$ of 1 rood		13	$1\frac{1}{2}$	=rent of 1 rood.
			1	$7\frac{1}{2}\cdot\frac{3}{4}q.$	=rent of 5 poles.
		£62	8	$6-\frac{3}{4}q.$	=rent of 23 ac. 3 ro. 5 po.

		£	s.	d.	
38.	1 qr. $=\frac{1}{4}$ of 1 cwt.	2	0	7	=value of 1 cwt.
				7	
		14	4	1	=value of 7 cwt.
	14 lbs. $=\frac{1}{2}$ of 1 qr.		10	$1\frac{3}{4}$	=value of 1 qr.
	1 lb. $=\frac{1}{14}$ of 14 lbs.		5	$0\frac{7}{8}$	=value of 14 lbs.
	$\frac{1}{2}$ lb. $=\frac{1}{2}$ of 1 lb.			$4\frac{39}{112}$	=value of 1 lb.
				$2\frac{39}{224}$	=value of $\frac{1}{2}$ lb.
		£14	19	$10\frac{33}{224}d.$	=value of 7 cwt. 1 qr. $15\frac{1}{2}$ lbs.

		£	s.	d.	
39.	10 poles $=\frac{1}{4}$ of 1 rood	0	13	$10\frac{1}{2}$	=rent of 1 rood.
				10	
		6	12	1	=rent of 10 roods.
				10	
		66	0	10	=rent of 100 roods.
				9	
		594	7	6	=rent of 900 roods.
			13	$2\frac{1}{2}$	=rent of 1 rood.
		595	0	$8\frac{1}{2}$	=rent of 901 ro. or 225 ac. 1 ro.
	8 poles $=\frac{1}{5}$ of 1 rood		3	$3\frac{5}{8}$	=rent of 10 poles.
	1 pole $=\frac{1}{8}$ of 8 poles		2	$7\frac{7}{10}$	=rent of 8 poles.
				$3\frac{77}{80}$	=rent of 1 pole.
		£595	6	$11\frac{3}{4}\cdot\frac{3}{20}q.$	=rent of 225 ac. 1 ro. 19 po.

		£	s.	d.	
40.	2 pecks $=\frac{1}{2}$ of 1 bush.	0	5	$8\frac{1}{4}$	=cost of 1 bushel.
				10	
		2	16	$10\frac{1}{2}$	=cost of 10 bushels.
				9	
		25	11	$10\frac{1}{2}$	=cost of 90 bushels.
				2	
		51	3	9	=cost of 180 bus. or 22 qrs. 4 bus.
	1 peck $=\frac{1}{2}$ of 2 pecks		2	$10\frac{1}{8}$	=cost of 2 pecks.
			1	$5\frac{1}{16}$	=cost of 1 peck.
		£51	8	$0\frac{3}{16}$	=cost of 22 qrs. 4 bus. 3 pks.

		£	s.	d.	
41.	14 lbs. = $\frac{1}{8}$ of 1 cwt.	5	11	$7\frac{3}{5}$	= cost of 1 cwt.
				5	
		27	18	2	= cost of 5 cwt.
				11	
		306	19	10	= cost of 55 ct. or 2 tons 15 ct.
	8 lbs. = $\frac{1}{14}$ of 1 cwt.		13	$11\frac{9}{20}$	= cost of 14 lbs.
	4 lbs. = $\frac{1}{2}$ of 8 lbs.		7	$11\frac{24}{35}$	= cost of 8 lbs.
	1 lb. = $\frac{1}{4}$ of 4 lbs.		3	$11\frac{59}{70}$	= cost of 4 lbs.
				$11\frac{269}{280}$	= cost of 1 lb.
		£308	6	$8\frac{3}{4}.\frac{53}{70}q.$	= cost of 2 tons 15 cwt. 27 lbs.

		£	s.	d.	
42.	3 sq. ft. = $\frac{1}{3}$ of 1 sq. yd.	0	13	$7\frac{3}{4}$	= cost of 1 sq. yard.
				4	
		2	14	7	= cost of 4 sq. yards.
				12	
		32	15	0	= cost of 48 sq. yards.
	3 sq. ft. = $\frac{1}{3}$ of 1 sq. yd.		4	$6\frac{7}{12}$	= cost of 3 sq. feet.
	1 sq. ft. = $\frac{1}{3}$ of 3 sq. ft.		4	$6\frac{7}{12}$	= cost of 3 sq. feet.
	1 sq. ft. = $\frac{1}{3}$ of 3 sq. ft.		1	$6\frac{7}{36}$	= cost of 1 sq. foot.
	72 sq. in. = $\frac{1}{2}$ of 1 sq. ft.		1	$6\frac{7}{36}$	= cost of 1 sq. foot.
	36 sq. in. = $\frac{1}{2}$ of 72 sq. in.			$9\frac{7}{72}$	= cost of 72 sq. inches.
	6 sq. in. = $\frac{1}{6}$ of 36 sq. in.			$4\frac{79}{144}$	= cost of 36 sq. inches.
				$\frac{655}{864}$	= cost of 6 sq. inches.
		£33	8	$3\frac{3}{4}.\frac{181}{216}$	= cost of 48 sq. yd. 8 s. ft. 114 s. in.

		£	s.	d.	
43.	4 qts. = $\frac{1}{36}$ of 1 bar.	2	0	6	= cost of 1 barrel.
		1	0	3	= cost of $\frac{1}{2}$ barrel.
		3	0	9	= cost of $1\frac{1}{2}$ barrel or 1 hhd.
				2	
		6	1	6	= cost of 2 hhds.
		2	0	6	= cost of 1 barrel.
	1 qt. = $\frac{1}{4}$ of 4 qts.		1	$1\frac{1}{2}$	= cost of 4 quarts.
				$3\frac{1}{4}.\frac{1}{2}q.$	= cost of 1 quart.
		£8	3	$4\frac{3}{4}.\frac{1}{2}q.$	= cost of 2 hhds. 1 bar. 5 qts.

Ex. LIV. (p. 170.)

(1) The area = (2 ft. 9 in. × 10 ft. 4 in.)

$$= (2\tfrac{3}{4} \times 10\tfrac{1}{3})\text{ sq. ft.} = \left(\frac{11}{4} \times \frac{31}{3}\right)\text{ sq. ft.}$$

$$= \frac{341}{12}\text{ sq. ft.} = 28\tfrac{5}{12}\text{ sq. ft.} = 3\text{ sq. yds. }1\text{ sq. ft. }60\text{ sq. in.}$$

(2) The area $= (17\frac{1}{4} \times 13\frac{5}{6})$ sq. ft.

$$= \left(\frac{69}{4} \times \frac{83}{6}\right) \text{sq. ft.} = \frac{1909}{8} \text{sq. ft.} = 238 \text{ sq. ft. } 90 \text{ sq. in.}$$

(3) Area of ground $= (9\frac{1}{4} \times 3\frac{5}{12})$ sq. ft.

$$= \left(\frac{37}{4} \times \frac{41}{12}\right) \text{sq. ft.} = \frac{1517}{48} \text{sq. ft.} = 31 \text{ sq. ft. } 87 \text{ sq. in.}$$

(4) $$\text{Length of room} = \frac{\text{content of room in square feet}}{\text{width of room in linear feet}}$$

$$= \frac{91 \times 9}{15\frac{1}{2}} \text{ft.} = \frac{91 \times 9 \times 2}{31} \text{ft.} = \frac{1638}{31} \text{ft.} = 52\tfrac{26}{31} \text{ ft.}$$

(5) $$\text{Length of plot} = \frac{\text{content of plot in square feet}}{\text{breadth of plot in linear feet}}$$

$$= \frac{832}{26} \text{ft.} = 32 \text{ ft.}$$

(6) $$\text{Breadth of room} = \frac{\text{area in square feet}}{\text{length of room in feet}}$$

$$= \frac{795}{2} \div \frac{45}{2} = \frac{795}{45} = \frac{159}{9} = 17 \text{ ft. } 8 \text{ in.}$$

(7) $$\text{Number of planks required} = \frac{\text{area of floor in square inches}}{\text{area of each plank in square inches}}$$

$$= \frac{50 \times 12 \times 16 \times 12}{150 \times \frac{17}{2}} = \frac{12 \times 16 \times 12 \times 2}{3 \times 17} = \frac{1536}{17} = 90\tfrac{6}{17}.$$

(8) Area of building $= (78\frac{5}{12} \times 78\frac{5}{12})$ sq. ft.

$$= \left(\frac{941 \times 941}{12 \times 12}\right) \text{sq. ft.} = \frac{885481}{144} \text{sq. ft.} = 6149\tfrac{25}{144}$$

$= 683$ sq. yds. 2 sq. ft. 25 sq. in.

(9) Area $= (30\frac{1}{2} \times 8\frac{3}{4})$ sq. ft.

$$= \frac{61 \times 35}{2 \times 4} \text{sq. ft.} = \frac{2135}{8} \text{sq. ft.};$$

$$\therefore \text{cost} = \left(\frac{2135}{8} \times \frac{14}{3}\right) s. = \frac{14945}{12} = £62.\ 5s.\ 5d.$$

(10) Area of slab $= (5\frac{7}{12} \times 3\frac{2}{3})$ sq. ft.;

$$\therefore \text{cost} = \left(\frac{67}{12} \times \frac{11}{3} \times 3\right) s. = \frac{737}{12} s. = £3.\ 1s.\ 5d.$$

(11) Area of floor $=(18\tfrac{1}{2}\times 12\tfrac{1}{4})$ sq. ft. $=\dfrac{37\times 49}{2\times 4\times 9}$ sq. yds.;

$\therefore$ cost of carpet $=\dfrac{37\times 49\times 3}{2\times 4\times 9}\,s.=\dfrac{1813}{24}\,s.=£3.\ 15s.\ 6\tfrac{1}{2}d.$

(12) 1. Area $\doteq(23\tfrac{1}{2}\times 20)$ sq. ft. $=470$ sq. ft. $=\dfrac{470}{9}$ sq. yds.;

$\therefore$ cost of painting $=\left(\dfrac{470\times 9}{9\times 2}\right)s.=235s.=£11.\ 15s.$

2. Area $=(14\tfrac{1}{4}\times 11\tfrac{11}{12})$ sq. ft. $=\left(\dfrac{57\times 143}{4\times 12}\right)$ sq. ft.;

$\therefore$ cost $=\left(\dfrac{57\times 143\times 16}{4\times 12}\right)d.=(19\times 143)d.=2717d.=£11.\ 6s.\ 5d.$

3. Area $=(13\tfrac{1}{2}\times 8\tfrac{3}{4})$ sq. ft. $=\left(\dfrac{27\times 35}{2\times 4\times 9}\right)$ sq. yds.;

$\therefore$ cost $=\left(\dfrac{27\times 35}{2\times 4\times 9}\times\dfrac{23}{3}\right)s.=\dfrac{805}{8}\,s.=£5.\ 0s.\ 7\tfrac{1}{2}d.$

(13) 1.

$$\begin{array}{rcrcl}
\text{ft.} & & \text{in.} & & \\
18 & . & 9 & & \\
14 & . & 7 & & \\
\hline
262 & . & 6 & & \\
10 & . & 11 & . & 3'' \\
\hline
\end{array}$$

sq. ft. $273\ .\ 5\ .\ 3''=\left(273+\dfrac{5}{12}+\dfrac{3}{144}\right)$ sq. ft.

$=\left(273+\dfrac{63}{144}\right)$ sq. ft. $=273$ sq. ft. 63 sq. in.

Proof by fractions.

$(18\tfrac{3}{4}\times 14\tfrac{7}{12})$ sq. ft. $=\left(\dfrac{75\times 175}{4\times 12}\right)$ sq. ft.

$=\dfrac{4375}{16}$ sq. ft. $=273$ sq. ft. 63 sq. in.

2.

$$\begin{array}{rcl}
\text{ft.} & & \\
23 & . & 8' \\
16 & . & 9 \\
\hline
378 & . & 8 \\
17 & . & 9 \\
\hline
\end{array}$$

$396\ .\ 5$ sq. ft. $=\left(396+\dfrac{5}{12}\right)$ sq. ft. $=396$ sq. ft. 60 sq. in.

Proof by fractions.

$(23\tfrac{2}{3}\times 16\tfrac{3}{4})$ sq. ft. $=\left(\dfrac{71\times 67}{12}\right)$ sq. ft. $=\dfrac{4757}{12}$ sq. ft. $=396$ ft. 60 sq. in.

$$\begin{array}{lrrrr}
 & \text{ft.} & & & \\
3. & 27\ . & 6'\ . & 9'' & \\
 & 5\ . & 3 & & \\
\cline{2-4}
 & 137\ . & 9\ . & 9 & \\
 & 6\ . & 10\ . & 8\ . & 3''' \\
\cline{2-5}
\text{sq. ft.} & 144\ . & 8\ . & 5\ . & 3
\end{array}$$

$$\begin{array}{lrrcrrrrr}
 & \text{ft.} & \text{in.} & & \text{ft.} & & & & \\
4. & 22\ . & 8\frac{3}{4} & = & 22\ . & 8'\ . & 9'' & & \\
 & 16\ . & 7\frac{1}{2} & = & 16\ . & 7\ . & 6 & & \\
\cline{5-7}
 & & & & 363\ . & 8\ . & 0 & & \\
 & & & & 13\ . & 3\ . & 1\ . & 3''' & \\
 & & & & & 11\ . & 4\ . & 4\ . & 6'''' \\
\cline{5-9}
 & & & \text{sq. ft.} & 377\ . & 10\ . & 5\ . & 7\ . & 6
\end{array}$$

$$\begin{array}{lrrrrr}
 & \text{ft.} & & & & \\
5. & 4\ . & 6'\ . & 5'' & & \\
 & 9\ . & 4\ . & 7 & & \\
\cline{2-4}
 & 40\ . & 9\ . & 9 & & \\
 & 1\ . & 6\ . & 1\ . & 8''' & \\
 & & 2\ . & 7\ . & 8\ . & 11'''' \\
\cline{2-6}
\text{sq. ft.} & 42\ . & 6\ . & 6\ . & 4\ . & 11''''
\end{array}$$

$$\begin{array}{lrrrr}
 & \text{ft.} & & & \\
6. & 75\ . & 7'\ . & 4'' & \\
 & 38\ . & 3\ . & 3 & \\
\cline{2-4}
 & 2873\ . & 2\ . & 8 & \\
 & 18\ . & 10\ . & 10\ . & 0''' \\
 & 1\ . & 6\ . & 10\ . & 10 \\
\cline{2-5}
\text{sq. ft.} & 2893\ . & 8\ . & 4\ . & 10
\end{array}$$

$$\begin{array}{lrrrrr}
 & \text{ft.} & & & & \\
7. & 17\ . & 2'\ . & 3'' & & \\
 & 15\ . & 11\ . & 7 & & \\
\cline{2-4}
 & 257\ . & 9\ . & 9 & & \\
 & 15\ . & 9\ . & 0\ . & 9''' & \\
 & & 10\ . & 0\ . & 3\ . & 9'''' \\
\cline{2-6}
\text{sq. ft.} & 274\ . & 4\ . & 10\ . & 0\ . & 9''''
\end{array}$$

(14) Area of floor $= (40\frac{2}{3} \times 24\frac{1}{2})$ sq. ft.

$$= \frac{122 \times 49}{3 \times 2} \text{ sq. ft.} = \frac{122 \times 49}{3 \times 2 \times 9} \text{ sq. yds.};$$

$$\therefore \text{ linear yards in carpet} = \frac{122 \times 49}{3 \times 2 \times 9} \div \frac{1}{2}$$

$$= \frac{122 \times 49}{27} \text{ yds.} = 221\tfrac{11}{27} \text{ yds.}$$

(15) Area of wall $= (15\frac{2}{3} \times 11\frac{1}{4})$ sq. ft.

$$= \frac{47 \times 45}{3 \times 4 \times 9} \text{ sq. yds.} = \frac{235}{12} \text{ sq. yds.};$$

$$\therefore \text{ linear yards of paper} = \left(\frac{235}{12} \div \frac{3}{4}\right) \text{yds.}$$

$$= \frac{235}{9} \text{ yds.} = 26 \text{ yds. } 0 \text{ ft. } 4 \text{ in.}$$

(16) Area of floor $= \left(\frac{20 \times 18}{9}\right)$ sq. yds. $= 40$ sq. yds.

$$\therefore \text{ linear yards in carpet} = \left(40 \div \frac{3}{4}\right) \text{yds.} = \frac{160}{3} \text{ yds.};$$

$$\therefore \text{ cost of carpet} = \left(\frac{160 \times 45}{3}\right) d. = 2400d. = \pounds 10.$$

(17) 1. Area of floor $=(12\frac{1}{3}\times 12\frac{1}{2})$ sq. ft. $=\frac{37\times 25}{3\times 2\times 9}$ sq. yds.;

$\therefore$ length of carpet $=\frac{37\times 25\times 4}{3\times 2\times 9\times 3}$ linear yds.

$\therefore$ cost of carpet $=\left(\frac{37\times 25\times 4\times 54}{3\times 2\times 9\times 3}\right)d.=\frac{3700}{3}d.=1233\frac{1}{3}d.$

$=£5.\ 2s.\ 9\frac{1}{3}d.$

2. Area of floor $=(29\frac{1}{2}\times 14\frac{1}{4})$ sq. ft. $=\frac{59\times 57}{2\times 4\times 9}$ sq. yds.;

$\therefore$ length of carpet $=\frac{59\times 57\times 8}{2\times 4\times 9\times 5}$ linear yds.;

$\therefore$ cost $=\frac{59\times 57\times 42}{9\times 5}d.=\frac{15694}{4}d.=£13.\ 1s.\ 6\frac{3}{4}d.\ \frac{1}{5}q.$

3. Area of floor $=(15\frac{1}{2}\times 12\frac{3}{4})$ sq. ft. $=\frac{31\times 51}{2\times 4\times 9}$ sq. yds.;

$\therefore$ length of carpet $=\frac{31\times 51\times 36}{2\times 4\times 9\times 24}$ linear yds.;

$\therefore$ cost $=\frac{31\times 51\times 36\times 92}{2\times 4\times 9\times 24}d.=\frac{36363}{12}d.=£12.\ 12s.\ 6\frac{1}{4}d.$

4. Area of floor $=\left(\frac{53}{2}\times 18\right)$ sq. ft. $=\frac{53\times 9}{9}$ sq. yds. $=53$ sq. yds.;

$\therefore$ length of carpet $=\frac{53\times 4}{3}$ linear yds.;

$\therefore$ cost $=\frac{212\times 40}{3}d.=\frac{8480}{3}d.=£11.\ 15s.\ 6\frac{1}{2}d.\ \frac{2}{3}q.$

5. Area of floor $=(19\frac{7}{12}\times 18\frac{11}{12})$ sq. ft. $=\frac{235\times 227}{12\times 12\times 9}$ sq. yds.;

$\therefore$ length of carpet $=\frac{235\times 227\times 36}{12\times 12\times 9\times 25}$ yds.;

$\therefore$ cost $=\frac{235\times 227\times 36\times 56}{12\times 12\times 9\times 25}d.=\frac{47\times 227\times 14}{3\times 3\times 5}d.$

$=\frac{149366}{45}d.=£13.\ 16s.\ 7\frac{11}{45}d.$

(18) 1. Content of timber $= (54\frac{1}{2} \times 5 \times 2\frac{5}{12})$ cub. ft.

$$= \frac{109 \times 5 \times 29}{2 \times 12} \text{ c. ft.} = \frac{15805}{24} \text{ c. ft.} = 658 \text{ c. ft. } 936 \text{ c. in.};$$

$$\therefore \text{ cost} = \frac{15805 \times 9}{24} d. = \frac{47415}{8} d. = £24.\ 13s.\ 10\tfrac{3}{4}d.\ \tfrac{1}{2}q.$$

2. Content of cube $= (1\frac{2}{3} \times 1\frac{2}{3} \times 1\frac{2}{3})$ c. ft.

$$= \frac{5 \times 5 \times 5}{3 \times 3 \times 3} \text{ c. ft.} = \frac{125}{27} \text{ c. ft.} = 4 \text{ c. ft. } 1088 \text{ c. in.};$$

$$\therefore \text{ cost} = \left(\frac{125}{27} \times 1728 \times 6\right) d. = (125 \times 64 \times 6)d.$$

$$= \frac{125 \times 64 \times 6}{20 \times 12} £ = (25 \times 8)£ = 200£.$$

3. Content of cellar $= (12 \times 12 \times 12)$ c. ft.

$$= \frac{12 \times 12 \times 12}{27} \text{ c. yds.} = 64 \text{ c. yds.};$$

$$\therefore \text{ cost} = (64 \times 9)d. = £2.\ 8s.$$

4. Content of cistern $= \left(6 \times \frac{5}{2} \times \frac{5}{2}\right)$ c. ft.

$$= \frac{75}{2} \text{ c. ft.} = 1 \text{ c. yd. } 10\tfrac{1}{2} \text{ c. ft.}$$

5. Content of wall $= (1000 \times \frac{21}{2} \times 2\frac{1}{8})$ c. ft. $= \frac{125 \times 21 \times 17}{2}$ c. ft.

$$= \frac{44625}{2} \text{ c. ft.} = 826 \text{ c. yds. } 10\tfrac{1}{2} \text{ c. ft.}$$

6. Content of cube $= (13\frac{91}{144} \times 13\frac{91}{144} \times 13\frac{91}{144})$ c. ft.

$$= \frac{1963 \times 1963 \times 1963}{144 \times 144 \times 144} \text{ c. ft.} = \frac{7564163347}{2985984} \text{ c. ft.}$$

$$= 2533\tfrac{665875}{2985984} \text{ c. ft.}$$

(19) Area of floor $= (23\frac{10}{12} \times 18\frac{1}{3})$ sq. ft.

$$= \frac{143 \times 55}{6 \times 3} \text{ sq. ft.} = \frac{7865}{18} \text{ sq. ft.} = 436 \text{ s. ft. } 136 \text{ s. in.}$$

Volume of room $= (23\frac{5}{6} \times 18\frac{1}{3} \times 11\frac{1}{4})$ c. ft.

$$= \frac{7865 \times 45}{18 \times 4} \text{ c. ft.} = \frac{353925}{72} \text{ c. ft.} = 4915 \text{ c. ft. } 1032 \text{ c. in.}$$

(20) Area of walls = 2(length + breadth) × height

$$= (2 \times 42 \times 12\tfrac{5}{6})\text{ sq. ft.} = (2 \times 7 \times 77)\text{ sq. ft.};$$

$$\therefore \text{length of paper} = \left(\frac{2 \times 7 \times 77}{9} \times \frac{8}{7}\right)\text{yds.} = \frac{1232}{9}\text{yds.}$$

$$= 136 \text{ yds. } 2 \text{ ft. } 8 \text{ in.}$$

(21) Area of walls = 2(length + breadth) × height

$$= (2 \times 39\tfrac{11}{12} \times 11\tfrac{1}{2})\text{ sq. ft.} = \frac{479 \times 23}{12}\text{ sq. ft.};$$

$$\therefore \text{cost} = \frac{479 \times 23 \times 48}{12}d. = 44068d. = £183.\ 12s.\ 4d.$$

(22) 1. Area of walls = 2(length + breadth) × height

$$= (2 \times 32\tfrac{5}{12} \times 14)\text{ sq. ft.}$$

Area of ceiling = length × breadth = $(16\tfrac{2}{3} \times 15\tfrac{3}{4})$ sq. ft.;

$$\therefore \text{whole content} = \left(\frac{389 \times 7}{3} + \frac{25 \times 21}{2}\right)\text{sq. ft.}$$

$$= \left(\frac{2723}{3} + \frac{525}{2}\right)\text{sq. ft.} = \frac{7021}{6}\text{ sq. ft.};$$

$$\therefore \text{cost} = \frac{7021}{6 \times 9}s. = 130\tfrac{1}{54}s. = £6.\ 10\tfrac{1}{54}s.$$

2. Area to be painted = area of walls + area of ceiling

$$= (2 \times 25 \times 9\tfrac{3}{4})\text{ sq. ft.} + (15 \times 10)\text{ sq. ft.}$$

$$= \left(\frac{975}{2} + 150\right)\text{ sq. ft.} = \frac{1275}{2 \times 9}\text{ sq. yds.};$$

$$\therefore \text{cost} = \frac{1275 \times 16}{2 \times 9}d. = \frac{850}{9}s. = £4.\ 14s.\ 5\tfrac{1}{4}d.\ \tfrac{1}{3}q.$$

3. Area of walls = $\left(\frac{83}{2} \times \frac{101}{12}\right)$ ft. = $\frac{83 \times 101}{2 \times 12 \times 9}$ sq. yds.;

$$\therefore \text{cost} = \frac{83 \times 101 \times 11}{2 \times 12 \times 9}d. = \frac{92213}{216}d. = £1.\ 15s.\ 6\tfrac{3}{4}d.\ \tfrac{35}{54}q.$$

4. Area of walls = $(72 \times 10\tfrac{1}{4})$ sq. ft.

$$= (18 \times 41)\text{ sq. ft.} = \frac{18 \times 41}{9}\text{sq. yds.};$$

$$\therefore \text{cost} = (2 \times 41 \times 10\tfrac{1}{2})d. = 861d. = £3.\ 11s.\ 9d.$$

Again, area of walls in Ex. 1. $= \frac{389 \times 7}{3 \times 9}$ sq. yds.;

$\therefore$ length of paper required $= \left(\frac{389 \times 7}{3 \times 9} \times \frac{36}{21}\right)$ yds. $= \frac{389 \times 4}{9}$ yds.;

$\therefore$ cost $= \frac{389 \times 4 \times 42}{9}$ *d.* = £30. 5*s.* 1⅓*d.*

Also, area of walls in Ex. 2. $= \left(\frac{975}{2 \times 9}\right)$ sq. yds.;

$\therefore$ length of paper required $= \left(\frac{975}{2 \times 9} \times \frac{36}{21}\right)$ yds. $= \frac{325 \times 2}{7}$ yds.;

$\therefore$ cost $= \frac{325 \times 2 \times 14}{7}$ *d.* = 1300*d.* = £5. 8*s.* 4*d.*

(23) Area of walls = 2(22 ft. 3 in. + 17 ft. 9 in.) × (12 ft. 6 in.)
= 2(40 × 12½) sq. ft. = 1000 sq. ft.;

$\therefore$ length of paper required $= \frac{1000}{2}$ ft. = 500 ft. = 166 yds. 2 ft.;

and cost at 3*d.* per foot will be 1500*d.* = £6. 5*s.*

(24) £6. 5*s.* ÷ 5*s.* = 25, the number of sq. yards in the carpet;

$\therefore$ breadth of room $= \frac{25 \times 9}{25}$ ft. = 9 ft.

(25) Area of court = (96 × 84) sq. ft. = 8064 sq. ft.;
area of grass plots = (4 × 22½ × 18) sq. ft. = 1620 sq. ft.;
$\therefore$ the number of sq. ft. to be paved = 8064 − 1620 = 6444;

$\therefore$ number of sq. yds. $= \frac{6444}{9} = 716$;

$\therefore$ cost = (716 × 8½)*d.* = 6086*d.* = £25. 7*s.* 2*d.*

(26) (Required breadth in linear yards × 74⅔) = 94½ × 1⅛;

$\therefore$ breadth $= \left(\frac{189 \times 9}{2 \times 8} \div \frac{224}{3}\right)$ yds. $= \left(\frac{189 \times 9 \times 3}{2 \times 8 \times 224}\right)$ yds.

$= \frac{5103}{3584}$ yds. $= 1\frac{1519}{3584} = 1\frac{217}{512}$ yds.

(27) Area of room $= (16\frac{3}{4} \times 12\frac{11}{12})$ sq. ft. $= \frac{10385}{48}$ sq. ft.;

∴ number of sq. ft. of carpet remaining

$$= 313 - \frac{10385}{48} = \frac{4639}{48} = 96\tfrac{31}{48} = 96 \text{ sq. ft. } 93 \text{ sq. in.}$$

Also, price of carpet

$$= \left(\frac{10385}{48} \times \frac{1}{9} \times 3\tfrac{1}{2}\right) s. = \frac{72695}{864} s. = £4.\ 4s.\ 1\tfrac{47}{72}d.$$

(28) Area of each sod $= (2\frac{1}{2} \times \frac{3}{4})$ sq. ft.

Area of one strip $= \left(\frac{5 \times 3 \times 75}{2 \times 4}\right)$ sq. ft.

Area laid down daily $= \left(\frac{5 \times 3 \times 75 \times 5}{2 \times 4 \times 4}\right)$ sq. ft.

Area laid down in 8 days $= \left(\frac{5 \times 3 \times 75 \times 5}{4}\right)$ sq. ft.

∴ required space $= \frac{5625}{4}$ sq. ft. $=$ 156 sq. yds. 2 sq. ft. 36 sq. in.

(29) Area of first piece $= (151\frac{5}{12} \times 35)$ sq. yds. $= \left(\frac{1817 \times 35}{12}\right)$ sq. yds.;

∴ length of strip

$$= \left(\frac{1817 \times 35}{12} \div 15\tfrac{5}{6}\right) \text{yds.} = \frac{1817 \times 35 \times 6}{12 \times 95} \text{yds.} = 334 \text{ yds. } 2\tfrac{5}{38} \text{ ft.}$$

(30) Area of first floor $= (80\frac{3}{4} \times 65\frac{1}{2})$ sq. ft. $= \frac{42313}{8}$ sq. ft.

Area of 3 other floors $= 3\left(\frac{323}{12} \times \frac{131}{6}\right)$ sq. ft. $= \frac{42313}{24}$ sq. ft.;

∴ difference of content

$$= \left(\frac{42313}{8} - \frac{42313}{24}\right) = \frac{42313}{12} \text{ sq. ft.} = 391 \text{ sq. yds. } 7 \text{ sq. ft. } 12 \text{ sq. in.}$$

(31) Cubic content of part drawn off

$$= (24\tfrac{2}{3} \times 12\tfrac{3}{4} \times 1) \text{ c. ft.} = \frac{74 \times 51}{3 \times 4} \text{ c. ft.} = \frac{629}{2} \text{ c. ft.} = 314\tfrac{1}{2} \text{ c. ft.}$$

(32) 1532 sq. ft. $9\frac{9}{12}$ sq. in. ÷ 81 ft. 9 in. $= 1532\frac{13}{16}$ sq. ft. ÷ $81\frac{3}{4}$ ft.

$$= \frac{24525 \times 4}{16 \times 327} \text{ ft.} = \frac{75}{4} \text{ ft.} = 18 \text{ ft. } 9 \text{ in.,}$$

also breadth of room $= 250\frac{5}{6}$ sq. ft. $\div 17\frac{1}{2}$ ft.

$$= \frac{1505 \times 2}{6 \times 35} \text{ ft.} = 14\tfrac{1}{3} \text{ ft.}$$

(33) Area of windows of ground and first floors

$= (24 \times 7\frac{1}{2} \times 3\frac{1}{2})$ sq. ft. $= 630$ sq. ft.;

area of windows in second floor

$= (12 \times 6\frac{5}{6} \times 3\frac{1}{2})$ sq. ft. $= 287$ sq. ft.;

area of windows in third floor

$= (12 \times 6 \times 3\frac{1}{2})$ sq. ft. $= 252$ sq. ft.;

$\therefore$ amount of glazing $= 1169$ sq. ft.;

$\therefore$ cost $= 11690d. = £48.\ 14s.\ 2d.$

(34) Content of wall $= (60 \times 7\frac{1}{2} \times 1\frac{1}{6})$ c. ft. $= (5 \times 15 \times 7)$ c. ft.;

content of each brick $= (9 \times 3\frac{1}{2} \times 2\frac{1}{2})$ c. in. $= \dfrac{9 \times 7 \times 5}{4 \times 1728}$ c. ft.;

$\therefore$ number of bricks required

$$= (5 \times 15 \times 7) \div \left(\frac{9 \times 7 \times 5}{4 \times 1728}\right) = \frac{5 \times 15 \times 7 \times 4 \times 1728}{9 \times 7 \times 5}$$

$$= 5 \times 4 \times 576 = 11520.$$

(35) Content of cistern $= (18\frac{2}{3} \times 18\frac{1}{3} \times 6\frac{3}{4})$ c. ft. $= (14 \times 55 \times 3)$ c. ft.;

$\therefore$ weight of water $= (14 \times 55 \times 3 \times 1000)$ oz. $= 64$ tons 9 cwt. 7 lbs.

(36) A cubic rod of brickwork

$= (272\frac{1}{4} \times 1\frac{1}{6})$ c. ft., see p. 90 in Arithmetic.

Content of wall

$= (77 \times 16 \times 1\frac{7}{8})$ c. ft. $= (77 \times 2 \times 15)$ c. ft.;

$\therefore$ number of rods of brickwork

$$= \frac{77 \times 2 \times 15}{272\frac{1}{4} \times 1\frac{1}{6}} = \frac{77 \times 2 \times 15 \times 4 \times 6}{1089 \times 7} = \frac{80}{11} = 7\tfrac{3}{11}.$$

(37) Area of one side of chest $= (2\frac{5}{12} \times 2\frac{5}{12})$ sq. ft.;

$\therefore$ area of six sides $= \dfrac{6 \times 29 \times 29}{12 \times 12}$ sq. ft. $= \dfrac{6 \times 29 \times 29}{12 \times 12 \times 9}$ sq. yds.;

$$\therefore \text{cost} = \frac{29 \times 29 \times 15}{2 \times 12 \times 9} d. = \frac{4205}{72} d. = 4s.\ 10\tfrac{1}{4}d.\ \tfrac{11}{18}q.$$

(38) Area of walls $= 2(20\frac{1}{4}\text{ ft.} + 18\frac{1}{2})\text{ ft.} \times 10\text{ ft.} = 775$ sq. ft.,

area of windows $= (2 \times 7 \times 4)$ sq. ft. $= 56$ sq. ft.;

$\therefore$ area to be painted $= 719$ sq. ft.,

$$\therefore \text{cost} = \frac{719 \times 30}{9}\,d. = \frac{21570}{9}\,d. = £9.\ 19s.\ 8\tfrac{1}{2}d.\ \tfrac{2}{3}q.$$

(39) £19 ÷ 4*s.* 9*d*, gives 80 as the number of square yards in the cloth.

Now length × breadth = 80 sq. yds.;

$\therefore$ 5 breadth × breadth = 80 sq. yds.;

$\therefore$ breadth × breadth = 16 sq. yds.;

$\therefore$ breadth = 4 yards,

and length = 20 yards.

(40) Length of plank $\times 1\frac{1}{5}\text{ ft.} \times \frac{3}{4}\text{ ft.} = 11\frac{1}{4}$ c. ft.

$$\text{length} \times \frac{18}{20}\text{ sq. ft.} = \frac{45}{4}\text{ c. ft.};$$

$$\therefore \text{length} = \left(\frac{45}{4} \times \frac{20}{18}\right)\text{ft.} = \frac{25}{2}\text{ ft.} = 12\tfrac{1}{2}\text{ ft.}$$

(41) Content of Turkey carpet

$$= (11\tfrac{1}{2} \times 9\tfrac{2}{3})\text{ ft.} = \frac{667}{6}\text{ sq. ft.}$$

area of room $= (14 \times 12\frac{1}{2})$ sq. ft. $= 175$ sq. ft.;

$\therefore$ area to be covered with Brussels carpet

$$= \left(175 - \frac{667}{6}\right)\text{ sq. ft.} = \frac{383}{6}\text{ sq. ft.};$$

$\therefore$ length of Brussels carpet

$$= \left(\frac{383}{6 \times 9} \times \frac{4}{3}\right)\text{yds.} = \frac{766}{81}\text{ yds.} = 9\text{ yds. } 1\tfrac{10}{27}\text{ ft.};$$

$$\text{cost} = \left(\frac{766}{81} \times 45\right)d. = \frac{11490}{27}\,d. = £1.\ 15s.\ 5\tfrac{1}{2}d.\ \tfrac{2}{9}q.$$

(42)

$$\begin{array}{rrrr}
\text{ft.} & & & \\
20\,. & 4' & & \\
1\,. & 5 & & \\
\hline
20\,. & 4 & & \\
8\,. & 5\,. & 8'' & \\
\hline
28\,. & 9\,. & 8'' & \\
 & 10\,. & 0 & \\
\hline
24\,. & 0\,. & 0\,. & 8'''
\end{array} = 24\text{ cub. ft. } 8\text{ cub. in.}$$

$$= 24\tfrac{1}{216}\text{ cub. ft.}$$

Also, by fractions:

$$\text{cubic content} = \left(20\tfrac{1}{3} \times 1\tfrac{5}{12} \times \frac{10}{12}\right) \text{ c. ft.}$$

$$= \frac{61 \times 17 \times 10}{3 \times 12 \times 12} = \frac{5185}{216} \text{ c. ft.} = 24\tfrac{1}{216} \text{ c. ft.}$$

(43) Width of room × $10\frac{1}{2}$ yds. $= (69 \times \frac{3}{4})$ sq. yds.;

$$\therefore \text{ width of room} = \left(\frac{69 \times 3}{4} \times \frac{2}{21}\right) \text{ yds.} = \frac{69}{14} \text{ yds.} = 4\tfrac{13}{14} \text{ yds.}$$

(44) Area of walls

$$= 2\,(16\tfrac{5}{6} \text{ ft.} + 15\tfrac{3}{4}) \text{ ft.} \times 12\tfrac{1}{2} \text{ ft.} = (2 \times 32\tfrac{7}{12} \times 12\tfrac{1}{2}) \text{ sq. ft.}$$

$$= \frac{2 \times 391 \times 25}{12 \times 2} \text{ sq. ft.} = \frac{391 \times 25 \times 144}{12} \text{ sq. in.}$$

Area of a postage stamp $= (1 \times \frac{4}{5})$ sq. in.;

∴ number of stamps required

$$= \frac{391 \times 25 \times 12}{\frac{4}{5}} = \frac{391 \times 25 \times 12 \times 5}{4} = 391 \times 25 \times 3 \times 5 = 146625.$$

(45) Area of walls $= 2\,(36 + 24)$ ft. × 20 ft. $= 2400$ sq. ft.

Area of fire place $= (6 \times 5\frac{1}{2})$ sq. ft. $= 33$ sq. ft.

Area of windows $= (2 \times 7\frac{1}{2} \times 3\frac{3}{4})$ sq. ft. $= 56\frac{1}{4}$ sq. ft.;

∴ area for painting

$$= (2400 - 89\tfrac{1}{4}) \text{ sq. ft.} = 2310\tfrac{3}{4} \text{ sq. ft.} = 256\tfrac{3}{4} \text{ sq. yds.};$$

also length of paper required

$$= (2310\tfrac{3}{4} \div 2\tfrac{1}{4}) \text{ ft.} = \frac{9243}{9} \text{ ft.} = 1027 \text{ ft.};$$

$$\therefore \text{ cost of paper} = \frac{1027 \times 11}{3}\,d. = \frac{11297}{3}\,d. = £15.\ 13s.\ 9\tfrac{1}{2}d.\ \tfrac{2}{3}q.$$

(46) Content of each brick $= (9 \times 4\frac{1}{2} \times 3)$ c. in.;

content of wall $= (3600 \times 180 \times 22\frac{1}{2})$ c. in.;

∴ number of bricks required

$$= \left(\frac{3600 \times 180 \times 45}{2}\right) \div \left(\frac{9 \times 9 \times 3}{2}\right)$$

$$= \frac{3600 \times 180 \times 45}{9 \times 9 \times 3} = 400 \times 60 \times 5 = 24000 \times 5 = 120000.$$

(47) Area of garden $=(200 \times 180)$ sq. ft.;

$$\therefore \text{ area of path} = \frac{200 \times 180}{8} \text{ sq. ft.};$$

also length of path $=200$ ft.;

$$\therefore \text{ width of path} = \frac{200 \times 180}{8 \times 200} \text{ ft.} = \frac{180}{8} \text{ ft.} = 22\tfrac{1}{2} \text{ ft.}$$

(48) $$\text{Area of wall} = \left(45 \times 7 \times \frac{13}{12}\right) \text{ c. ft.} = \frac{1365}{4} \text{ c. ft.};$$

$$\text{area of door} = \left(6 \times 4 \times \frac{13}{12}\right) \text{ c. ft.};$$

$$\therefore \text{ area to be bricked} = \frac{1365-104}{4} \text{ c. ft.} = (1261 \times 432) \text{ c. in.};$$

$$\therefore \text{ number of bricks} = \frac{1261 \times 432}{108} = 1261 \times 4 = 5044.$$

(49) Area of road $=4(85+85+56+56)$ sq. yds. $+ (4 \times 16)$ sq. yds.
$=1192$ sq. yds.;
$\therefore$ cost $=(1192 \times 14)$ *d.* $=$ £69. 10*s.* 8*d.*

(50) Area to be paved $=(4 \times 225 \times 45)$ sq. ft. $+(4 \times 45 \times 45)$ sq. ft.
$=(1080 \times 45)$ sq. ft.;

$$\text{also area of each stone} = \frac{4}{15} \text{ sq. ft.};$$

$$\therefore \text{ number required} = \frac{1080 \times 45 \times 15}{4} = 182250.$$

(51) Area of court yard $=(126 \times 98)$ sq. ft.;
$\therefore$ cost of paving with pebbles

$$= \left(\frac{126 \times 98 \times 9}{9}\right) d. = (126 \times 98) d. = £51.\ 9s.;$$

area of granite path
$=(2 \times 5\tfrac{1}{2} \times 126)$ sq. ft. $+ (2 \times 5\tfrac{1}{2} \times 87)$ sq. ft. $= (11 \times 213)$ sq. ft.;

$$\therefore \text{ cost of path} = \frac{11 \times 213 \times 126}{9} d. = 32802d. = £136.\ 13s.\ 6d.$$

(52) Area of moat
$=2 \times (1902$ ft. $+ 34$ yds.$) \times 17$ yds. $+ (2 \times 1020$ ft. $\times 17$ yds.$)$
$= (2 \times 2004 \times 51)$ sq. ft. $+ (2 \times 1020 \times 51)$ sq. ft.
$=(102 \times 3024)$ sq. ft.

Again: quantity of soil on the lawn when raised two feet

$$=(1902\times 1020\times 2)\text{ cub. ft.};$$

therefore depth of moat $=\dfrac{1902\times 1020\times 2}{102\times 3024}$ ft.

$$=\frac{19020}{1512}\text{ ft.}=\frac{4755}{378}\text{ ft.}=\frac{1585}{126}\text{ ft.}=12\text{ ft. }6\tfrac{20}{21}\text{ in.}$$

(53) Area of 2 sides $=2\times 10$ ft. 3 in. $\times$ 5 ft. $4\frac{1}{2}$ in.,

area of 2 sides $=2\times 6$ ft. 6 in. $\times$ 5 ft. $4\frac{1}{2}$ in.,

area of bottom $=10$ ft. 3 in. $\times$ 6 ft. 6 in.;

therefore whole area to be lined with lead

$$=(10\tfrac{1}{4}\times 10\tfrac{3}{4}+6\tfrac{1}{2}\times 10\tfrac{3}{4}+10\tfrac{1}{4}\times 6\tfrac{1}{2})\text{ sq. ft.}$$

$$=\left(\frac{1763}{16}+\frac{559}{8}+\frac{533}{8}\right)\text{sq. ft.}=\frac{3947}{16}\text{ sq. ft.};$$

therefore weight of lead required $=\dfrac{3947}{2}$ lbs.;

therefore cost $=\dfrac{3947\times 42}{2\times 112}s.=\dfrac{11841}{16}s.=740\tfrac{1}{16}s.=£37.\ 0s.\ 0\tfrac{3}{4}d.$

(54) Content of cistern $=(87\times 44\times 34)$ cub. in.

Now an imperial gallon contains

227·274 cub. in. (see page 96 of *Arithmetic*);

therefore number of gallons

$$=\frac{87\times 44\times 34\times 1000}{277274}=\frac{65076000}{138637}=469\tfrac{55247}{138637}.$$

MISCELLANEOUS QUESTIONS AND EXAMPLES.

Ex. LV. (p. 183.)

I.

(1) $34{\cdot}17\div 3\frac{1}{4}=\dfrac{34{\cdot}17\times 4}{13}=\dfrac{136{\cdot}68}{13}=10{\cdot}51\dot{3}8461\dot{5}.$

(2) Value in £ $=£\,\dfrac{1556{\cdot}85}{24{\cdot}25}=£64{\cdot}2=£64.\ 4s.$

(3) $\frac{1}{3}+\frac{1}{6}+\frac{1}{14}+\frac{3}{56}=\frac{3}{6}+\frac{7}{56}=\frac{1}{2}+\frac{1}{8}=\frac{5}{8}=\cdot625.$

$$\begin{array}{r|l} & \text{lbs.} \\ 28\begin{cases}7\\4\end{cases} & \begin{array}{l}7.\\ \hline 1\cdot0\end{array} \\ 4 & \underline{1\cdot25} \\ \hline & \cdot3125 \end{array}$$

(4)

	£	s.	d.	
10*s.* = £$\frac{1}{2}$	365	0	0	= cost at £1 each ton
2*s.* = $\frac{1}{5}$ of 10*s.*	182	10	0	= cost at 10*s.* each
1*s.* = $\frac{1}{2}$ of 2*s.*	36	10	0	= cost at 2*s.* each
4*d.* = $\frac{1}{3}$ of 1*s.*	18	5	0	= cost at 1*s.* each
1*d.* = $\frac{1}{4}$ of 4*d.*	6	1	8	= cost at 4*d.* each
$\frac{1}{2}$*d.* = $\frac{1}{2}$ of 1*d.*	1	10	5	= cost at 1*d.* each
$\frac{1}{4}$*d.* = $\frac{1}{2}$ of $\frac{1}{2}$*d.*	0	15	2$\frac{1}{2}$	= cost at $\frac{1}{2}$*d.* each
	0	7	7$\frac{1}{4}$	= cost at $\frac{1}{4}$*d.* each
	245	19	10$\frac{3}{4}$	= cost of 365 tons
$\frac{1}{2}$ of 13*s.* 5$\frac{3}{4}$*d.* =	0	6	8$\frac{7}{8}$	= cost of $\frac{1}{2}$ ton
	£246	6	7$\frac{5}{8}$	= cost of 365$\frac{1}{2}$ tons.

	£	s.	d.	
2 ro. = $\frac{1}{2}$ ac.	1	16	8	= rent of 1 acre
			10	
	18	6	8	= rent of 10 acres
			10	
	183	6	8	= rent of 100 acres
			3	
	550	0	0	= rent of 300 acres
	18	6	8	= rent of 10 acres
	9	3	4	= rent of 5 acres
	577	10	0	= rent of 315 acres
1 ro. = $\frac{1}{2}$ of 2 ro.	0	18	4	= rent of 2 ro.
5 po. = $\frac{1}{8}$ of 1 ro.	0	9	2	= rent of 1 ro.
1 po. = $\frac{1}{5}$ of 5 po.	0	1	1$\frac{3}{4}$	= rent of 5 po.
1 po. = $\frac{1}{5}$ of 5 po.	0	0	2$\frac{3}{4}$	= rent of 1 po.
	0	0	2$\frac{3}{4}$	= rent of 1 po.
	£578	19	1$\frac{1}{4}$	= rent of 315 ac. 1 ro. 7 po.

(5)

	£	s.	d.
$\frac{5}{7}$ of the estate =	1003	17	1
$\frac{1}{7}$ of the estate =	200	15	5
the whole estate =	1405	7	11
therefore $\frac{1}{5}$ of the estate =	281	1	7
$\frac{2}{5}$ of the estate =	562	3	2

(6) 3*s.* 4*d.* in the £ is $\frac{1}{6}$ of any debt;
therefore amount received = $\frac{1}{6}$ of £3678. 16*s.* = £613. 2*s.* 8*d.*

(7) He sells $\frac{2}{7}$ of $\frac{5}{16}$ of $\frac{3}{14}$ of the estate;

therefore $\frac{5 \times 3}{7 \times 8 \times 14}$ of the estate $= £\frac{965}{8}$;

therefore the estate $= £\frac{965 \times 7 \times 8 \times 14}{5 \times 3 \times 8}$;

therefore $\frac{1}{5}$ of $\frac{3}{16}$ of the estate $= £\frac{965 \times 7 \times 14 \times 3}{5 \times 3 \times 5 \times 16}$

$$= £\frac{193 \times 49}{5 \times 8} = £\frac{9457}{40} = £236\tfrac{17}{40} = £236.\ 8s.\ 6d.$$

(8) The wife earns as much as 2 children,

the man earns as much as 6 children;

therefore $(2 + 6 + 3) \times$ (what each child earns) $= £1.\ 7s.\ 6d.$;

therefore each child earns $\frac{1}{11}$ of £1. 7*s*. 6*d*. = 2*s*. 6*d*.;

therefore the man earns (2*s*. 6*d*.) × 6 = 15*s*.

(9) 25 fr. 56 cent. = 2556 cent.;

therefore 1 florin $= \frac{1}{12}$ of 2556 cent. = 213 cent. = 2 fr. 13 cent.

(10)

	£	s.	d.
If 5 men in 6 weeks earn	14 .	5 .	0
1 man in 6 weeks earns	2 .	17 .	0
1 man in 1 week earns	0 .	9 .	6
4 men in 1 week earn	1 .	18 .	0

therefore number of weeks $= £19 \div (£1.\ 18s.) = \frac{19 \times 20}{38} = \frac{20}{2} = 10$ weeks.

II.

(1) 1 franc $= \frac{1}{26}$ of £1 $= \frac{20}{26}$ of 1 shilling $= \frac{10}{13}$ of a shilling.

(2) 1 yard $= \frac{32}{35}$ metre,

1760 yards $= \frac{32 \times 1760}{35}$ metres,

therefore $\frac{2}{3}$ of $\frac{14}{9}$ of a mile $= \frac{2 \times 14 \times 32 \times 1760}{3 \times 9 \times 35}$ metres

$$= \frac{45056}{27} \text{ metres} = 1668\tfrac{20}{27} \text{ metres.}$$

(3) For 28 cattle they pay £40;

therefore for 1 they pay $£\frac{40}{28}$;

therefore for 8 cattle *A* should pay $£\frac{40 \times 8}{28} = £\frac{80}{7} = £11.\ 8s.\ 6\tfrac{3}{4}d.\ \tfrac{3}{7}q.$

and for 9 cattle *B* pays $£\frac{40 \times 9}{28} = £12.\ 17s.\ 1\tfrac{1}{2}d.\ \tfrac{6}{7}q.$

and for 11 cattle *C* pays $£\frac{40 \times 11}{28} = £15.\ 14s.\ 3\tfrac{1}{4}d.\ \tfrac{5}{7}q.$

(4)

$$\begin{array}{r|l} 4 & 3\cdot0 \\ \hline 12 & 3\cdot75 \\ \hline 10 & \cdot3125 \\ \hline & \cdot03125 \end{array} \qquad \begin{array}{r} 12\cdot5)\ \cdot03125\ (\cdot0025 \\ 250 \\ \hline 625 \\ 625 \\ \hline \end{array}$$

(5)

	£	s.	d.	
2 ro. = ½ ac.	111	11	4	= value of 1 acre
			9	
	1004	2	0	= value of 9 acres
			5	
	5020	10	0	= value of 45 acres
1 ro. = ½ of 2 ro.	55	15	8	= value of 2 ro.
20 po. = ½ of 1 ro.	27	17	10	= value of 1 ro.
	13	18	11	= value of 20 po.
	£5118	2	5	= value of 45 ac. 3 ro. 20 po.

(6) £60000 has to produce £2500;

therefore £1 must produce $£\frac{2500}{60000} = £\frac{1}{24} = 10d.$

(7) Circumference of the wheel = $(5 \times 3\cdot14159)$ feet;

therefore number of revolutions made by the wheel

$$\text{in 10 miles} = \frac{10 \times 1760 \times 3}{5 \times 3\cdot14159} = \frac{10560}{3\cdot14159} = 3361\cdot3\ldots.$$

(8)

s.	d.		£	s.	d.	
4	9	× 7⅙ =	1	14	0½	= value of wheat
5	3	× 9¼ =	2	8	6¾	= value of malt
2	4	× 6²⁄₉ =	0	14	6²⁄₉	= value of oats
			£4	17	1¹⁷⁄₃₆	= rent.

Also, to find what he would pay in decimal coinage, we have

$$\begin{array}{rr|l}
 & & \quad d. \\
36\,\{ & 4 & 17\cdot00 \\ \cline{3-3}
 & 9 & 4\cdot25 \\ \cline{3-3}
 & 12 & 1\cdot47\dot{2} \\ \cline{3-3}
 & 2,0 & 17\cdot1226\dot{8}5\dot{1} \\ \cline{3-3}
 & & 4\cdot856134\dot{2}5\dot{9}
\end{array}$$

therefore he would pay £4. 8 fl. 5 c. $6\cdot134\dot{2}5\dot{9}$ m.

(9) *A* can do $\frac{1}{10}$ part of the work in one hour,
B can do $\frac{1}{12}$ part of the work in one hour;
A and *B* will do $(\frac{1}{10}+\frac{1}{12})$ or $\frac{11}{60}$ in one hour;
therefore they will complete the work in $\frac{60}{11}$ hours, or $5\frac{5}{11}$ hours.

(10) The first set in 1 hour dig $\frac{12}{16}$ of a load,
the second set in 1 hour dig $\frac{9}{15}$ of a load;
therefore both sets in 1 hour dig $(\frac{12}{16}+\frac{9}{15})$, or $\frac{27}{20}$ of a load;
therefore they dig 100 loads in $(100\div\frac{27}{20})$ hours,
i. e. in $\frac{2000}{27}$ hours, or $74\frac{2}{27}$ hours.

III.

(1)

$$\begin{array}{rr|rcrcrcr}
 & & \text{tons.} & & \text{cwt.} & & \text{qrs.} & & \text{lbs.} \\
36\,\{ & 4 & 28 & . & 4 & . & 3 & . & 0 \\ \cline{3-9}
 & 9 & 7 & . & 1 & . & 0 & . & 21 \\ \cline{3-9}
 & & & & 15 & . & 2 & . & 21
\end{array}$$

$$\begin{array}{l|rcrcrl}
 & \text{£} & & s. & & d. & \\
2\text{ qrs.}=\frac{1}{2}\text{ cwt.} & 7 & . & 10 & . & 8 & =\text{value of 1 cwt.} \\
 & & & & & 3 & \\ \cline{2-6}
 & 22 & . & 12 & . & 0 & =\text{value of 3 cwt.} \\
 & & & & & 5 & \\ \cline{2-6}
 & 113 & . & 0 & . & 0 & =\text{value of 15 cwt.} \\
14\text{ lbs.}=\frac{1}{4}\text{ of 2 qrs.} & 3 & . & 15 & . & 4 & =\text{value of 2 qrs.} \\
7\text{ lbs.}=\frac{1}{2}\text{ of 14 lbs.} & 0 & . & 18 & . & 10 & =\text{value of 14 lbs.} \\
 & 0 & . & 9 & . & 5 & =\text{value of 7 lbs.} \\ \cline{2-6}
 & \text{£}118 & . & 3 & . & 7 & =\text{value of 15 cwt. 2 qrs. 21 lbs.}
\end{array}$$

(2)

$$\begin{array}{rr|r}
 & 25 & 1\cdot00 \\ \cline{3-3}
 & 12 & 8\cdot04 \\ \cline{3-3}
 & 3 & 2\cdot67 \\ \cline{3-3}
22\,\{ & 2 & 186\cdot89 \\ \cline{3-3}
 & 11 & 93\cdot445 \\ \cline{3-3}
 & & 8\cdot495
\end{array}$$

and 8·495 chains = 8 chains, 4 chainlets, 9 links, 5 linklets.

(3) $25\frac{1}{2}$ francs $= £1 = 45$ pauls 9 baiocchi $= 45\frac{9}{10}$ pauls;

therefore 1 franc $= \left(\frac{459}{10} \div \frac{51}{2}\right)$ pauls;

therefore 20 francs $= \frac{459 \times 2 \times 20}{10 \times 51}$ pauls $= 36$ pauls.

(4) $£2514\frac{3}{8}$ produces $£83\frac{13}{16}$;

therefore £1 produces $£(83\frac{13}{16} \div 2514\frac{3}{8})$

$$= £\left(\frac{1341}{16} \times \frac{8}{20115}\right) = £\frac{1}{30} = 8d.;$$

and, therefore, $£115\frac{5}{8}$ pays $(115\frac{5}{8} \times 8)d. = 925d. = £3.\ 17s.\ 1d.$

(5)
$$\begin{array}{llll}
\overset{£}{1000} & \text{gains} & \overset{£}{90} & \text{in } 7 \text{ months,} \\
1000 & \ldots\ldots & 1 & \ldots\ \frac{7}{90} \text{ months,} \\
1 & \ldots\ldots & 1 & \ldots\ \frac{7 \times 1000}{90} \text{ months,} \\
315 & \ldots\ldots & 1 & \ldots\ \frac{7 \times 100}{9 \times 315} \text{ months,} \\
315 & \ldots\ldots & 20\frac{1}{4} & \ldots\ \frac{100}{9 \times 45} \times \frac{81}{4} \text{ months} = \frac{20}{4} \text{ months} = 5 \text{ months.}
\end{array}$$

(6)
$$\begin{array}{l|rrrl}
 & £ & s. & d. & \\
14 \text{ lbs.} = \frac{1}{2} \text{ qr.} & 4\ . & 6\ . & 0\frac{1}{2} & = \text{price of 1 qr.} \\
 & & & 5 & \\
\hline
 & 21\ . & 10\ . & 2\frac{1}{2} & = \text{price of 5 qrs.} \\
 & & & 3 & \\
\hline
 & 64\ . & 10\ . & 7\frac{1}{2} & = \text{price of 15 qrs.} \\
2 \text{ lbs.} = \frac{1}{7} \text{ of 14 lbs.} & 2\ . & 3\ . & 0\frac{1}{4} & = \text{price of 14 lbs.} \\
 & 0\ . & 6\ . & 1\frac{3}{4} & = \text{price of 2 lbs.} \\
\hline
 & £66\ . & 19\ . & 9\frac{1}{2} & = \text{price of 3 cwt. 3 qrs. 16 lbs.}
\end{array}$$

(7) Area of walls $= 2\,(\text{length} + \text{breadth}) \times \text{height}$

$$= (2 \times 35 \times 12) \text{ sq. ft.} = \frac{840}{9} \text{ sq. yds.};$$

therefore cost $= \left(\frac{280}{3} \times 2\frac{1}{2}\right)d. = \frac{280 \times 5}{3 \times 2}d.$

$$= \frac{700}{3}d. = 233\tfrac{1}{3}d. = 19s.\ 5\tfrac{1}{4}d.\ \tfrac{1}{3}q.$$

(8) Average length of year $= \left(365 + \frac{97}{400}\right)$ days

$$= \left(365 + \frac{\cdot 97}{4}\right) \text{ days} = 365{\cdot}2425 \text{ days.}$$

(9) 15 horses + 148 sheep eat as much as

$(3\times 84+148)$ sheep, or 400 sheep;

10 horses + 132 sheep eat as much as

$(2\times 84+132)$ sheep, or 300 sheep.

Then 400 sheep in 1 day cost $£\dfrac{75\frac{3}{4}}{9}$,

$$1 \ldots\ldots\ldots 1 \ldots\ldots\ldots £\frac{303}{9\times 4\times 400},$$

$$1 \ldots\ldots\ldots 8 \ldots\ldots\ldots £\frac{101\times 8}{3\times 4\times 400},$$

$$300 \ldots\ldots\ldots 8 \ldots\ldots\ldots £\frac{101\times 2\times 300}{3\times 400}=£\frac{101}{2}=£50.\ 10s.$$

(10) *A* does $\frac{1}{6}$ of the work in 1 hour,

B does $\frac{1}{12}$ of the work in 1 hour,

A, *B*, and *C* do $\dfrac{1}{2\frac{1}{2}}$ or $\frac{2}{5}$ of the work in 1 hour;

therefore *C* does in 1 hour $(\frac{2}{5}-\frac{1}{6}-\frac{1}{12})$ or $\frac{3}{20}$,

in 5 hours *C* does $\frac{3}{4}$ of the work,

and in 9 hours *B* does $\frac{9}{12}$, *i.e.* $\frac{3}{4}$ of the work.

IV.

(1) $729\times 37=26973.$

(2) $\frac{1}{5}$ of 1*s.* + $\frac{2}{7}$ of 5*s.* + $\frac{4}{9}$ of 21*s.* $=\left(\dfrac{1}{5}+\dfrac{10}{7}+\dfrac{28}{3}\right)s.=\dfrac{1151}{105}s.$;

therefore fraction $=\dfrac{1151}{105\times 20\times 25}=\dfrac{1151}{525\times 100}$

$$=\frac{11\cdot 51}{525}=\frac{2\cdot 302}{105}=\frac{\cdot 4604}{21}=\frac{\cdot 1534\dot{6}}{7}=\cdot 0219\dot{2}3809\dot{5}.$$

(3) The capital put in by both persons $=£(500+850)=£1350$;

therefore $\dfrac{500}{1350}$ = first person's share of the profit;

therefore first share $=\frac{10}{27}$ of $£375=£\dfrac{1250}{9}=£138.\ 17s.\ 9\frac{1}{3}d.$,

second share $=£375-£138.\ 17s.\ 9\frac{1}{3}d.=£236.\ 2s.\ 2\frac{2}{3}d.$

(4) Area of base $= \frac{1}{2}$ circumference $\times \frac{1}{2}$ diameter

$$= \tfrac{1}{2} \times 3\tfrac{1}{7} \text{ diameter} \times \tfrac{1}{2} \text{ diameter} = \tfrac{1}{2} \times 3\tfrac{1}{7} \times 2 \text{ ft.} \times \tfrac{1}{2} \times 2 \text{ ft.}$$

$$= \frac{1 \times 22 \times 2 \times 2}{2 \times 7 \times 2} \text{ sq. ft.} = \frac{22}{7} \text{ sq. ft.}$$

therefore content of column $= \left(\frac{22}{7} \times 15\right)$ cub. ft.;

therefore cost $= \left(\frac{22 \times 15 \times 31}{7 \times 2}\right)$ *s.* $=$ £36. 10*s.* $8\frac{1}{2}$*d.* $\frac{2}{7}$*q.*

(5) The men do the work in (12×6) hours $= 72$ hours;

therefore, if the day is 8 hours long,

they will take $\left(\frac{72}{8}\right)$ days $= 9$ days.

(6)

$$\begin{array}{rl}
\begin{array}{rcl} \textit{s.} & & \textit{d.} \\ 4 & . & 3 \\ 1 & . & 3\frac{1}{2} \\ 0 & . & 4\frac{1}{4} \\ 0 & . & 7\frac{3}{4} \end{array}
\begin{array}{l} \\ \times 10 = \\ \times 18 = \\ \times 23 = \\ \times 16 = \end{array}
\begin{array}{rcrcl} \pounds & & \textit{s.} & & \textit{d.} \\ 2 & . & 2 & . & 6 \\ 1 & . & 3 & . & 3 \\ 0 & . & 8 & . & 1\frac{3}{4} \\ 0 & . & 10 & . & 4 \end{array}
& \begin{array}{l} \\ = \text{value of tea} \\ = \text{value of coffee} \\ = \text{value of sugar} \\ = \text{value of candles} \end{array} \\
14 \begin{cases} 2 \\ 7 \end{cases}
\begin{array}{|rcrcl} \hline 4 & . & 4 & . & 2\frac{3}{4} \\ \hline 2 & . & 2 & . & 1\frac{3}{8} \\ \hline 0 & . & 6 & . & 0\frac{11}{56} \end{array}
& \begin{array}{l} = \text{entire cost} \\ \\ = \text{share of each person.} \end{array}
\end{array}$$

(7) $(2375\frac{3}{4} \times 40)$*d.* $= 95030$*d.* $=$ £395. 19*s.* 2*d.*,

and 2*s.* $3\frac{7}{8}$*d.* $\times 1000000 = \left(\frac{223}{8} \times 1000000\right)$*d.*

$= (27875000)$*d.* $=$ £116145. 16*s.* 8*d.*

(8) Area covered in each revolution $= (6\frac{1}{2} \times 2\frac{1}{4})$ sq. ft.,

area covered in all the revolutions

$$= \left(10 \times 12 \times \frac{13}{2} \times \frac{9}{4}\right) \text{ sq. ft.} = (195 \times 9) \text{ sq. ft.} = 195 \text{ sq. yds.}$$

(9) *C*'s share $= \frac{2}{3}$ *B*'s share, *A*'s share $= \frac{5}{4}$ *B*'s share;

therefore $\frac{5}{4}$ *B*'s share $+$ *B*'s share $+ \frac{2}{3}$ *B*'s share $=$ £1400;

therefore $\frac{35}{12}$ *B*'s share $=$ £1400;

therefore *B*'s share $=$ £$\frac{1400 \times 12}{35} =$ £480,

C's share $= \frac{2}{3}$ of £480 $=$ £320,

A's share $= \frac{5}{4}$ of £480 $=$ £600.

(10) Take 3 gallons of the mixture.

These consist of 2 parts brandy and 1 part rum,

and they cost the merchant (£4. 10*s.* + £1. 1*s.*) or £5. 11*s.*

He then sells them for £2. 5*s.* × 3, or £6. 15*s.*;

therefore he gains on 3 gallons of the mixture £1. 4*s.*

therefore on each gallon he gains $\frac{24}{3}$ *s.* = 8*s.*

V.

(1) 550974 ÷ 1472 = 374 with remainder 446.

(2) $\frac{6}{45}, \frac{5}{7}, \frac{9}{35}$, L. C. D. is 315,

and the fractions become

$$\frac{6\times7}{45\times7},\ \frac{5\times45}{7\times45},\ \frac{9\times9}{35\times9},\ \text{or}\ \frac{42}{315},\ \frac{225}{315},\ \frac{81}{315},$$

and their sum $= \frac{42+225+81}{315} = \frac{348}{315} = 1\frac{11}{105}$.

(3) $1\text{ oz. Avoird.} = \frac{7000}{16}\text{ grs. Troy} = \frac{7000}{16\times20\times24\times12\times40}$ of 40 lbs. Troy

$$= \frac{7000}{16\times20\times24\times12\times40}\text{ of 1869 sovereigns}$$

$$= \frac{70\times1869}{16\times2\times24\times12\times4}\text{ sovereigns}$$

$$= \frac{21805}{6144}\text{ sovereigns} = 3\tfrac{3373}{6144}\text{ sovereigns.}$$

(4) Value for 1 year = (27500000 × 45)*s.*,

value for $\frac{1}{4}$ year $= £\frac{27500000\times45}{4\times20} = £(1718750\times9) = £15468750$.

(5) The first set in 1 hour mow $\frac{4}{3}$ acres,

the second set in 1 hour mow $\frac{8}{5}$ acres;

therefore together in 1 hour they mow $\frac{44}{15}$ acres;

therefore they mow 44 acres in 15 hours,

and 11 acres in $(\frac{15}{4})$ hours, or $3\frac{3}{4}$ hours.

(6) (1) number of cubic feet of water = area of base × depth

$$=\left(\frac{1344}{144}\times\frac{15}{4}\right)\text{ cub. ft.} = 35\text{ cub. ft.},$$

(2) depth of cistern $=\dfrac{\text{cubic content}}{\text{area of base}}=\dfrac{35\times 1728}{1088}$ in. $= 4$ ft. $7\frac{10}{17}$ in.

(7) He does the work in $(8\frac{1}{2}\times 6)$ hours, or 51 hours;

therefore if he has to finish it in 5 days,

he must work each day $\dfrac{51}{5}$ hours, or 10 hours 12 min.

(8) 1 man $=\dfrac{11}{7}$ woman,

11 men + 7 women $=\left(\dfrac{121}{7}+7\right)$ women $=\dfrac{170}{7}$ women.

Now, by the question,

1 woman does the work in (11×17) days;

therefore 170 women do the work in $\left(\dfrac{11\times 17}{170}\right)$ days;

therefore $\dfrac{170}{7}$ women do the work in $\dfrac{11\times 17\times 7}{170}$ days;

therefore the time required is $\dfrac{77}{10}$ days, or $7\frac{7}{10}$ days.

(9) Area of doors $= 2\,(8\times 3\frac{3}{4})$ sq. ft. $= 60$ sq. ft.,

area of 1 window $= (5\times 7)$ sq. ft. $= 35$ sq. ft.,

area of 2 windows $= 2\,(5\times 4)$ sq. ft. $= 40$ sq. ft.;

therefore area of the parts not requiring paper $= 135$ sq. ft.

Again, area of walls $= 2\,(20\frac{1}{2}+15\frac{1}{2})$ ft. × 16 ft.

$= (2\times 36\times 16)$ sq. ft. $= 1152$ sq. ft.;

therefore area of paper required $= (1152-135)$ sq. ft.;

therefore cost at 10*d.* a sq. yd. $=\dfrac{1017\times 10}{9}$*d.* $= 1130$*d.* $=$ £4. 14*s.* 2*d.*

(10) Debts amount to £1215. 19*s.* 2*d.*, or £$1215\frac{23}{24}$,

and the estate is worth £$911\frac{155}{160}$.

If the bankrupt has £1, he pays $\frac{1}{1215\frac{23}{24}}$ of debts,

as he has £$911\frac{155}{160}$, he pays $\frac{911\frac{155}{160}}{1215\frac{23}{24}}$ of debts,

and this fraction reduced becomes $\frac{3}{4}$;
therefore he pays 15*s.* in the £.

		£	*s.*	*d.*		£	*s.*	*d.*
Also *A* receives	$\frac{3}{4}$ of	515	12	6	or	386	14	$4\frac{1}{2}$
B	$\frac{3}{4}$ of	407	0	0	or	305	5	0
C	$\frac{3}{4}$ of	293	6	8	or	220	0	0

VI.

(1) £10. 17*s.* $6\frac{3}{4}$*d.* × 8764 = £95335. 17*s.* 9*d.*

	£	*s.*	*d.*	
10*s.* = $\frac{1}{2}$ of £1	8764	0	0	= value at £1 each.
			10	
	87640	0	0	= value at £10 each.
5*s.* = $\frac{1}{2}$ of 10*s.*	4382	0	0	= value at 10*s.* each.
1*s.* = $\frac{1}{5}$ of 5*s.*	2191	0	0	= value at 5*s.* each.
1*s.* = $\frac{1}{5}$ of 5*s.*	438	4	0	= value at 1*s.* each.
6*d.* = $\frac{1}{2}$ of 1*s.*	438	4	0	= value at 1*s.* each.
$\frac{3}{4}$*d.* = $\frac{1}{8}$ of 6*d.*	219	2	0	= value at 6*d.* each.
	27	7	9	= value at $\frac{3}{4}$*d.* each.
	£95335	17	9	= value at £10. 17*s.* $6\frac{3}{4}$*d.* each.

(2) For every 11*s.* in his assets he owes 20*s.*;

therefore his debts $=\frac{20}{11}$ of his assets $=\frac{20}{11}$ of 10846*s.*

$$=£\,\frac{10846}{11}=£986.$$

(3) True length = $10\frac{1}{2}$ yds. — $(10\frac{1}{2}\times\frac{2}{3})$ in. = $10\frac{1}{2}$ yds. — 7 in. = 10 yds. 11 in.

(4) 420 thalers = (420 × 3) shillings

$$=£\,\frac{420\times 3}{20}=\frac{420\times 3\times 24}{20}\text{ francs}=1512\text{ francs}.$$

(5) 6 oz. of almonds cost $\frac{6\times 10}{16}d.=3\frac{3}{4}d.$,

$\frac{3}{4}$ lb. of raisins cost $\frac{3\times 11}{4}d.=8\frac{1}{4}d.$;

therefore whole cost = $(3\frac{3}{4}+8\frac{1}{4})d.$ = 1 shilling.

(6)

	£	s.	d.	
2 qrs. $=\frac{1}{2}$	6	0	0	= price of 1 cwt.
			5	
	30	0	0	= price of 5 cwt.
1 qr. $=\frac{1}{2}$	3	0	0	= price of 2 qrs.
14 lbs. $=\frac{1}{2}$	1	10	0	= price of 1 qr.
	0	15	0	= price of 14 lbs.
	35	5	0	= price of 5 cwt. 3 qrs. 14 lbs.
	7	16	8	
	£27	8	4	= reduced price.

Now 5 cwt. 3 qrs. 14 lbs. = 658 lbs., and £27. 8*s*. 4*d*. = 6580*d*.;

therefore price of each lb. $= \frac{6580}{658}$ *d*. = 10*d*.

(7)

	£	s.	d.
The sugar costs him	30	0	0
he pays for expenses	0	12	6
he has to gain	15	6	3
therefore he must sell it for	45	18	9

Now 10 cwt. 3 qrs. 21 lbs. = 1225 lbs., and £45. 18*s*. 9*d*. = 11025*d*.;

therefore price of each lb. $= \frac{11025}{1225}$ *d*. = 9*d*.

(8) Area of walls $= 2 \times (20 \text{ ft.} + 16\tfrac{1}{2} \text{ ft.}) \times 12 \text{ ft.} = (73 \times 12)$ sq. ft.;

therefore quantity of paper required $= \frac{73 \times 12}{9}$ sq. yds.

Now $(12 \times \frac{3}{4})$ sq. yds., or 9 sq. yds. cost 54*d*.;

therefore 1 sq. yd. costs 6*d*.;

therefore cost of paper $= \frac{73 \times 12 \times 6}{9}$ *d*. $= (73 \times 8)$*d*. = £2. 8*s*. 8*d*.

(9) Length of pole $= (35 \times 12)$ in. = 420 in.

Now in 24 hrs. the snail creeps up 15 in.;

therefore in (24×26) hrs. the snail creeps up (15×26) in., or 390 in.;

therefore he has (420—390) in., or 30 in. to get up.

And he goes over 1 in. in $\frac{12}{31}$ hrs.,

and over 30 in. in $\frac{12 \times 30}{31}$ hrs.;

therefore he reaches the top in $\left(24 \times 26 + \frac{12 \times 30}{31}\right)$ hrs.,

or in $(624 + 11\tfrac{19}{31})$ hrs. $= 635\tfrac{19}{31}$ hrs.

(10)

	£	*s.*	*d.*	
Wages of 3 foremen weekly =	6	6	0	
.... 10 shopmen .... =	10	10	0	
.... 5 assistants .... =	4	7	6	
total amount of wages =	21	3	6	
weekly profits =	54	6	5	
difference =	33	2	11	
			10	
	331	9	2	for 10 weeks
			5	
	1657	5	10	for 50 weeks
	66	5	10	for 2 weeks
annual income =	1723	11	8	for 1 year
annual outgoings =	723	11	8	
net profit =	1000	0	0	

VII.

(1) $\frac{2}{3}$ of $\frac{1}{4}$ of 13 guineas $= \frac{2\times13\times21}{3\times4}\,s. = \frac{13\times7}{2}\,s. = \frac{91}{2}\,s. =$ £2. 5*s*. 6*d*.

Again, £2. 5*s*. 6*d*. = 91 sixpences, and £237. 10*s*. = 9500 sixpences;

therefore fraction $= \frac{91}{9500} = \frac{\cdot91}{95} = \cdot0095......$

(2) £5. 6*s*. $3\frac{1}{4}$*d*. = 5101*q*., £85. 0*s*. 4*d*. = 81616*q*.;

therefore number $= \frac{81616}{5101} = 16.$

Again, $(4+2+1)$ times the third part = £34. 13*s*.,

or 7 times the third part = £34. 13*s*.;

therefore third part = £4. 19*s*.,

second part = £9. 18*s*.,

first part = £19. 16*s*.

(3)

days.	
365·25	= length of civil year
365·242264	= true length of year
·007736	= annual defect.

Since, therefore, $\frac{7736}{1000000}$ of 1 day is the defect each year,

number of years required $= \frac{1000000}{7736} = \frac{125000}{967} = 129\frac{257}{967}.$

(4) 1 man mows 300 acres in (15×17) days,

1 man mows 1 acre in $\frac{15 \times 17}{300}$ days,

27 men mow 167 acres in $\frac{15 \times 17 \times 167}{300 \times 27}$ days $= \frac{2839}{540}$ days $= 5\frac{139}{540}$ days.

(5) 6 times the work may be done in 12 days by 120 men;

therefore 6 times the work may be done in $\frac{12}{10}$ days by 1200 men.

(6) $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{1}{3} = \frac{1}{5}$;

	£	s.	d.
therefore value of my share was	1032	4	9
and $\frac{1}{6}$ of the ship's value is	860	3	$11\frac{1}{2}$
therefore value of part remaining is	172	0	$9\frac{1}{2}$

(7) Since £900 has £675 to meet it,

£1 has £$\frac{675}{900}$, or £$\frac{3}{4}$ to meet it,

also claim of third creditor will be

£(900—125—375), or £400;

therefore he receives $\frac{3}{4}$ of £400, or £300.

(8) Area of first cistern $= (13\frac{1}{3} \times 8 \times 5\frac{1}{4})$ cub. ft.

$= \frac{40 \times 8 \times 21}{3 \times 4}$ cub. ft. $= 560$ cub. ft.,

area of second cistern $= (7 \times 6\frac{2}{3} \times 6)$ cub. ft.

$= \left(\frac{7 \times 20 \times 6}{3}\right)$ cub. ft. $= 280$ cub. ft.;

therefore first content = twice second content.

(9) 60*s.* × number of workmen in first class = wages of first class,

63*s.* × number of workmen in first class = wages of second class,

154*s.* × number of workmen in first class = wages of third class;

therefore 277*s.* × number of workmen in first class = wages of all

= £96. 19*s.* = 1939*s.*;

therefore number of workmen in first class $= \frac{1939}{277} = 7$;

therefore number of workmen $= 7 + 14 + 77 = 98$.

(10)

£	francs.	francs.	cents.
1	= 25¼	= 25	25
400	= (10000 + 100)	= 10100	0
5		= 126	25
⅓		= 8	41⅔
therefore 405. 6*s*. 8*d*.		= 10234	66⅔

VIII.

(1) 13 lbs. 9 oz. = 165 oz.

	£	*s*.	*d*.	
2 dwts. = $\frac{1}{10}$ of 1 oz.	3	5	0	
			10	
	32	10	0	= cost of 10 oz.
			10	
	325	0	0	= cost of 100 oz.
	195	0	0	= cost of 60 oz.
	16	5	0	= cost of 5 oz.
	536	5	0	= cost of 165 oz.
	0	6	6	= cost of 2 dwts.
1 dwt. = ½ of 1 dwt.	0	3	3	= cost of 1 dwt.
	£536	14	9	= value required.

(2) £1. 11*s*. 6¼*d*. = 1513*q*., 2 florins = 96*q*.;

therefore number $= \frac{1513}{96} = 15\frac{73}{96}$.

(3) 3 kreutzers = 1 penny,

1 kreutzer $= \frac{1}{3 \times 240}$ of £1,

5 kreutzers $= \frac{5 \times 12}{3 \times 240}$ of a gulden $= \frac{1}{12}$ of a gulden.

(4) 12*s*. 4*d*. is $\frac{37}{60}$ of £1;

therefore he first receives $\frac{37}{60}$ of £296 = £182. 10*s*. 8*d*.,

the deficiency is then £113. 9*s*. 4*d*.;

and since 3*s*. 9*d*. is $\frac{3}{16}$ of £1,

he next receives $\frac{3}{16}$ of £113. 9*s*. 4*d*. = £21. 5*s*. 6*d*.;

therefore in all he receives £203. 16*s*. 2*d*.

(5) 12 ft. $4\frac{1}{2}$ in. $= 148\frac{1}{2}$ in. $= \frac{297}{2}$ in.,

1 mile $= (1760 \times 3 \times 12)$ in.;

therefore fraction $= \dfrac{297}{1760 \times 3 \times 12 \times 2} = \dfrac{9 \times 11 \times 3}{11 \times 160 \times 3 \times 12 \times 2} = \dfrac{3}{1280}$

and $\dfrac{3}{1280} = \dfrac{\cdot375}{160} = \dfrac{\cdot046875}{20} = \cdot00234375.$

(6) The edition will cover $(29040 \times 3 \times \frac{7}{2} \times 2)$ sq. ft. $= (29040 \times 21)$ sq. ft

one acre $= (4840 \times 9)$ sq. ft.;

therefore number of acres $= \dfrac{29040 \times 21}{4840 \times 9} = \dfrac{9680 \times 7}{4840} = 2 \times 7 = 14.$

(7) Income-tax $= (200 \times 7)d. = 2800$ halfpence,

and he has to save 3 halfpence on each lb.;

therefore number of pounds of sugar $= \dfrac{2800}{3} = 933\frac{1}{3}$ lbs.;

therefore he must use 8 cwt. $37\frac{1}{3}$ lbs. of sugar.

(8) *B*'s work in 24 hours $=$ *A*'s work in 20 hours;

therefore *A* could do $\frac{1}{2}$ the work in $(12+20)$ hours, or in 32 hours;

therefore *C* does $\frac{1}{2}$ the work in $(\frac{9}{5} \times 32)$ hours, or in $57\frac{3}{5}$ hours.

(9) $\cdot\dot{3}$ of £1 $= \frac{3}{9}$ of £1 $= \frac{1}{3}$ of £1 $= 6s.\ 8d.$

(10)

$$\begin{array}{rr|rcrcr|l}
 & & \pounds & & s. & & d. & \\
 & \pounds3000 \times 52 = & 156000 & . & 0 & . & 0 & \text{annual earnings} \\
 & \pounds775.\ 14s.\ 2d. \times 52 = & 40336 & . & 16 & . & 8 & \text{annual expenses} \\
\hline
10 & & 115663 & . & 3 & . & 4 & \\
 & & 11566 & . & 6 & . & 4 & \\
\hline
 & & 104096 & . & 17 & . & 0 & \\
 & & 24141 & . & 13 & . & 8 & \\
\hline
 & & \pounds79955 & . & 3 & . & 4 & \text{net profit.}
\end{array}$$

IX.

(1) $\dfrac{9275}{371} + \dfrac{1522842}{719} = 25 + 2118 = 2143.$

(2) $\dfrac{2}{5} = \dfrac{2\cdot0}{5} = \cdot4,$

$\dfrac{75}{1875} = \dfrac{15}{375} = \dfrac{3}{75} = \dfrac{1}{25} = \dfrac{1\cdot00}{25} = \cdot04.$

(3) $\frac{1}{3}-\frac{1}{6}-\frac{1}{24}=\frac{8-4-1}{24}=\frac{3}{24}=\frac{1}{8}$;

and since $8=2\times2\times2$, the fraction will become a finite decimal.

Again, $\dfrac{\frac{1}{3}+\frac{1}{4}}{\frac{1}{2}+\frac{1}{3}}$ of £1 $=\dfrac{\frac{7}{12}}{\frac{5}{6}}$ of £1 $=\dfrac{7\times6}{5\times12}$ of £1 $=\frac{7}{10}$ of £1 $=14s.$

(4) $(\frac{2}{3}-\frac{1}{2})$ of the term $=13\frac{1}{3}$ days;

therefore $\frac{1}{6}$ of the term $=13\frac{1}{3}$ days;

therefore the term $=(13\frac{1}{3}\times6)$ days $=80$ days.

(5)

$$\begin{array}{r|l} 4 & 2{\cdot}0 \\ \hline 12 & 6{\cdot}5 \\ \hline 2{,}0 & 17{\cdot}541\dot{6} \\ \hline & £19{\cdot}87708\dot{3} \end{array}$$

Ans. £19. 8 f. 7 c. 7 m. with $\cdot08\dot{3}$ m. over,

and $\cdot08\dot{3}$ m. $=\frac{83-8}{900}$ m. $=\frac{75}{900}$ m. $=\frac{1}{12}$ m.

(6) Area of field $=7$ ac. 1 ro. 15 po. $=46064700$ sq. in.,

length of field $=453$ yds. 2 ft. 3 in. $=16335$ in.;

therefore breadth $=\frac{46064700}{16335}$ in. $=2820$ in. $=78$ yds. 1 ft.

(7)

$$\begin{array}{rcl} & s.\ \ \ d. & \\ 3d.\times2\frac{1}{6} & =0\ .\ 6\frac{1}{2} & =\text{price of milk} \\ 2s.\times\frac{1}{12} & =0\ .\ 2\ \ & =\text{price of lemon} \\ 1s.\times\ \frac{1}{8} & =0\ .\ 1\frac{1}{2} & =\text{price of 2 eggs} \\ 13s.\times\ \frac{1}{8} & =1\ .\ 7\frac{1}{2} & =\text{price of rum} \\ 24s.\ 8d.\times\frac{1}{16} & =\underline{1\ .\ 6\frac{1}{2}} & =\text{price of brandy} \\ & 4\ .\ 0\ \ & =\text{whole cost.} \end{array}$$

(8) The English hen while eating a pint of barley lays 10 eggs; and these are equivalent to 15 Cochin China eggs. Consequently the English hen lays 15 eggs to the other hen's 12 eggs, and is the more economical layer.

(9) $(20 \times 3 \times 1\frac{1}{2} \times 4)$ cub. ft. $= 360$ cub. ft. $=$ content of first trench,

$(30 \times 3 \times 2\frac{1}{4} \times 5)$ cub. ft. $= \frac{2025}{2}$ cub. ft. $=$ content of second trench;

therefore since $\overset{\text{cub. ft.}}{360}$ are dug in $\overset{\text{hours.}}{30}$ by $\overset{\text{men.}}{72}$

$$1 \;\ldots\ldots\ldots\; 30 \text{ by } \frac{72}{360}$$

$$1 \;\ldots\ldots\ldots\; 1 \text{ by } \frac{72 \times 30}{360}$$

$$1 \;\ldots\ldots\ldots\; 135 \text{ by } \frac{72 \times 30}{135 \times 360}$$

$$\frac{2025}{2} \;\ldots\ldots\ldots\; 135 \text{ by } \frac{72 \times 30 \times 2025}{2 \times 135 \times 360}$$

therefore number of men $= \frac{3 \times 2025}{135} = \frac{2025}{45} = \frac{405}{9} = 45.$

(10) Wages of men $= £(420 \times 3) = £1260$;

therefore wages of boys $= £(1500 - 1260) = £240$;

therefore number of boys $= \frac{240 \times 20}{30} = 80 \times 2 = 160.$

X.

(1) $\frac{3}{5} + \cdot061 = \cdot6 + \cdot061 = \cdot661$;

$\cdot02 - \cdot003 = \cdot017$;

$\cdot0672 \div \cdot006 = 11\cdot2.$

(2) $\frac{2}{3} \text{ of } \frac{7}{11} - \frac{1}{2} \text{ of } \frac{5}{6} = \frac{14}{33} - \frac{5}{12} = \frac{1}{132}$,

and $\frac{1}{132} \times \left(\frac{3}{7} \text{ of } \frac{5}{8}\right) = \frac{3 \times 5}{132 \times 7 \times 8} = \frac{5}{2464}.$

(3)

$$\begin{array}{r|l} 4 & \underline{2\cdot0} \\ 12 & \underline{7\cdot5} \\ 2{,}0 & \underline{10\cdot625} \\ & £25\cdot53125 \end{array}$$

therefore £25. 10*s.* 7½*d.* = £25. 5 fl. 3 c. 1¼ m. = 255 fl. 3 c. 1¼ m.

(4)
$$\begin{array}{lccl} & \text{men.} & \text{days.} & \quad d. \\ \text{Since} & 6 & \text{in } \frac{15}{2} & \text{earn } 1755 \\ & 1 & \text{in } \frac{15}{2} & \text{earns } \frac{1755}{6} \\ & 1 & \text{in } 1 & \text{earns } \frac{1755 \times 2}{15 \times 6} \\ & 10 & \text{in } 1 & \text{earn } \frac{1755 \times 2 \times 10}{15 \times 6} \\ & 10 & \text{in } \frac{47}{4} & \text{earn } \frac{1755 \times 2 \times 10 \times 47}{15 \times 6 \times 4} \end{array}$$

therefore earnings $= \frac{1755 \times 47}{18} d. = \frac{195 \times 47}{2} d. =$ £19. 1*s.* 10½*d.*

(5) £72 $= (72 \times 20 \times 12)d.$, 2*s.* 2*d.* $= 26d.$;

therefore number of yards $= \frac{72 \times 20 \times 12}{26} = \frac{8640}{13} = 664\frac{8}{13}$.

(6) Gas consumed in 1 hour $= (10 \times 4 \times 60 \times 60)$ cub. in.;

therefore cost $= \frac{10 \times 4 \times 60 \times 60 \times 6}{1728 \times 1000} s. = \frac{6 \times 6 \times 6}{432} s. = \frac{216}{432} s. = \frac{1}{2} s. = 6d.$

(7)

£	s.	d.	
0 .	7 .	8	= price of 1 bushel
		8	
3 .	1 .	4	= price of 1 quarter
		8	
24 .	10 .	8	= price of 8 quarters
1 .	18 .	4	= price of 5 bushels
0 .	3 .	10	= price of 2 pecks
0 .	1 .	11	= price of 1 peck
£26 .	14 .	9	= price of 8 qrs. 5 bus. 3 pks.

Also 8 qrs. 6 bush. 2 pecks = 70½ pecks;

therefore price $= (423 \div 70\frac{1}{2})s. = \frac{423 \times 2}{141} s. = (3 \times 2)s. = 6s.$

(8) Area of wall $= (15\frac{2}{3} \times 11\frac{1}{4})$ sq. ft. $= \left(\frac{47 \times 45}{3 \times 4 \times 9}\right)$ sq. yds.;

therefore length of paper required

$$= \frac{47 \times 45 \times 4}{3 \times 4 \times 9 \times 3} \text{ yds.} = \frac{47 \times 5}{9} \text{ yds.} = 26\tfrac{1}{9} \text{ yds.} = 26 \text{ yds. } 4 \text{ in.}$$

(9) Area of parallelopiped $=(222\times 63\times 36)$ cub. in.,

area of cube $=(11\times 11\times 11)$ cub. in.;

therefore value of wood

$$=\frac{222\times 63\times 36\times 42}{11\times 11\times 11}d.=\frac{21146722}{1331}d.=\pounds 66.\ 3s.\ 11\tfrac{1235}{1331}d.$$

(10)
$$\text{Since } \overset{\text{men.}}{36} \text{ dig } 72\times \overset{\text{cub. yds.}}{18}\times 12 \text{ in } \overset{\text{hours.}}{8\times 16},$$

$$1 \text{ digs} \quad 1 \quad \text{in } \frac{8\times 16\times 36}{72\times 18\times 12},$$

$$32 \text{ dig } 64\times 27\times 18 \text{ in } \frac{8\times 16\times 36\times 64\times 27\times 18}{32\times 72\times 18\times 12};$$

therefore number of hours $=\dfrac{8\times 16\times 27\times 18}{18\times 12}=2\times 16\times 9$;

therefore number of days $=\dfrac{2\times 16\times 9}{12}=2\times 4\times 3=24$.

XI.

(1) $\frac{11}{133}=\cdot\dot{0}8270676691729323\dot{3}$,

and value at £300 the unit $=$ £24. 16*s.* $2\frac{3}{4}d.\ \frac{78}{133}q.$

(2) If £1 pays a rate of 8*d.*,

£3070 pay a rate of $(3070\times 8)\,d.$;

therefore average charge per acre $=\dfrac{3070\times 8}{2456}d.=10d.$

(3) If $2\frac{1}{2}$ lbs. cost 10*d.*, 1 lb. will cost 4*d.*,

also 2 tons 16 cwt. 17 lbs. $=6289$ lbs.;

therefore price required $=(6289\times 4)d.=$ £104. 16*s.* 4*d.*

(4) It must be sold for £7. 14*s.*, or 154 shillings;

therefore price per lb. $=\dfrac{154}{112}s.=\dfrac{22}{16}s.=\dfrac{11}{8}s.=1s.\ 4\frac{1}{2}d.$

(5) $\cdot 000035511\dot{3}\dot{6}=\dfrac{3551136-35511}{99000000000}$;

therefore value in inches $=\dfrac{3515625\times 1760\times 3\times 12}{99000000000}$ in.

$$=\frac{3515625\times 160\times 4}{1000000000}\text{ in.}=\frac{2250000000}{1000000000}\text{ in.}=2\cdot 25\text{ in.}=2\tfrac{1}{4}\text{ in.}$$

(6) $5s. = 60d.$ and $2\frac{2}{5}d. = 2{\cdot}4d.$;

therefore $5s. = \frac{60}{2{\cdot}4} = 25$, $2s.\ 6d. = \frac{1}{2}$ of $5s. = 12{\cdot}5$, $1s. = \frac{1}{5}$ of $5s. = 5$,

$6d. = \frac{1}{2}$ of $1s. = 2{\cdot}5$, $4d. = \frac{1}{3}$ of $1s. = 1{\cdot}\dot{6}$, $3d. = \frac{1}{4}$ of $1s. = 1{\cdot}25$.

Also, $\frac{1}{10}$ of $2\frac{2}{5}d. = \frac{12}{50}d. = \frac{6}{25}d.$;

therefore in this unit of money one halfpenny $= \frac{\frac{1}{2}}{\frac{6}{25}} = \frac{25}{12} = 2{\cdot}08\dot{3}$.

(7) $4s.\ 3\frac{3}{5}d. = 5{\cdot}42$ fr., or $\frac{258}{5}d. = \frac{542}{100}$ fr.;

therefore $1d. = \frac{542 \times 5}{258 \times 100}$ fr.;

therefore $£1 = \frac{542 \times 5 \times 240}{258 \times 100}$ fr. $= \frac{1084}{43}$ fr. $= 25\frac{9}{43}$ fr.

Also, when unit of money is $\frac{6}{25}d.$,

a dollar $= \frac{258}{5} \div \frac{6}{25} = \frac{258 \times 25}{5 \times 6} = 215$ units,

a franc $= \left(\frac{258}{5} \div \frac{542}{100}\right) \div \frac{6}{25} = \frac{258 \times 100 \times 25}{5 \times 542 \times 6}$

$= \frac{215 \times 100}{542} = \frac{10750}{271} = 39\frac{181}{271}$ units.

(8) A and B do $\frac{1}{6}$ daily, B and C do $\frac{1}{7}$ daily;

therefore, taking these successively from the work done by A, B, and C daily, we have

A's work daily $= \frac{1}{4} - \frac{1}{7}$, C's work daily $= \frac{1}{4} - \frac{1}{6}$;

therefore A and C do daily $\frac{1}{4} - \frac{1}{7} + \frac{1}{4} - \frac{1}{6}$, or $\frac{4}{21}$ of the work;

therefore A and C do it in $\frac{21}{4}$ days, or $5\frac{1}{4}$ days.

(9) Area of sheet $= (66 \times 30)$ sq. inches;

therefore each sheet will give a strip (66×30) linear inches in length and 1 linear inch broad;

therefore number required $= \frac{25000 \times 1760 \times 3 \times 12}{66 \times 30}$

$= 25000 \times 16 \times 2 = 800000$ sheets.

(10) $(20\times 12)d.\times$ number of sovereigns $=$ value of the sovereigns in pence,

$(12\times 3)d.\times$ number of sovereigns $=$ value of the shillings in pence,

$4d.\times$ number of sovereigns $=$ value of the pence;

$\therefore$ $(240+36+4)d.\times$ number of sovereigns $=$ value of coins in pence;

therefore $280d.\times$ number of sovereigns $=(280\times 20\times 12)d.$;

therefore number of sovereigns $=\dfrac{280\times 20\times 12}{280}=240$,

number of shillings $=240\times 3=720$,

number of pence $=240\times 4=960$.

RULE OF THREE.

Ex. LVI. (p. 207.)

(1) 4 yds. : 96 yds. :: 12*s.* : required cost;

therefore required cost $=\dfrac{96\times 12}{4}s.=£14.\ 8s.$

(2) £5. 12*s.* : £44. 16*s.* :: 9 yds. : required number of yds.;

therefore number of yards required $=\dfrac{896\times 9}{112}=72$.

(3) 7 bus. : 3 bus. :: £1. 16*s.* 9*d.* : required cost;

therefore required cost $=\dfrac{(£1.\ 16s.\ 9d.)\times 3}{7}=15s.\ 9d.$

(4) £63 : £273 :: 42 ac. : number of acres required;

therefore number of acres $=\dfrac{42\times 273}{63}=182$.

(5) 72 tons : 54 tons :: £55. 16*s.* : required cost;

therefore required cost $=\dfrac{54\times 1116}{72}s.=£41.\ 17s.$

(6) 6 : 13 :: £3. 16*s.* 6*d.* : value required;

therefore value required $=\dfrac{13\times 918}{6}d.=£8.\ 5s.\ 9d.$

(7) 1*s.* 6*d.* : £3 :: 1 week : number of weeks required;

therefore number of weeks $=\dfrac{720}{18}=40$.

(8) 15 : 20 :: 9 : number required;

therefore number required $=\dfrac{20\times 9}{15}=12$.

(9) £6. 14*s.* 2*d.* : £29. 15*s.* :: 2 cwt. 3 qrs. 14 lbs. : quantity of sugar required;

therefore required quantity $=\dfrac{7140\times 322}{1610}$ lbs. = 12 cwt. 3 qrs.

(10) 3 cwt. 3 qrs. : 2 cwt. 2 qrs. :: £6. 16*s* : price required;

therefore price required $=\dfrac{10\times 136}{15}$ *s.* = £4. 10*s.* 8*d.*

(11) 4 yds. 31 in. : 23 yds. 1 ft. :: £3. 15*s.* : price required;

therefore price required $=\dfrac{840\times 75}{175}$ *s.* = £18.

(12) £1 : £257. 10*s.* :: 7*d.* : required tax;

therefore required tax $=\dfrac{5150\times 7}{20}$ *d.* = £7. 10*s.* 2½*d.*

(13) £185. 10*s.* : £1050 :: £5. 8*s.* 2½*d.* : required tax;

therefore required tax $=\dfrac{21000\times 5194}{3710}$ *q.* = £30. 12*s.* 6*d.*

(14) £429. 8*s.* 3*d.* : £302. 3*s.* 7*d.* :: 13*s.* 6*d.* : required tax;

therefore required tax $=\dfrac{72523\times 162}{103059}$ *d.* = 9*s.* 6*d.*

(15) 5*s.* 10*d.* : £27. 5*s.* 5*d.* :: 1 bus. : number of bus. required;

therefore number of bus. $=\dfrac{6545}{70}=$ 11 qrs. 5 bus. 2 pks.

(16) 1 qr. : 2 tons 3 cwt. 14 lbs. :: 8*s.* 9½*d.* : price required;

therefore price required $=\dfrac{4830\times 422}{28}$ *q.* = £75. 16*s.* 6¾*d.*

(17) 7*d.* : £10. 1*s.* 3*d.* :: £1 : half year's income;

therefore half year's income = £ $\dfrac{2415}{7}$ = £345;

therefore year's income = £690.

(18) 1 day : 215 days :: 2*s.* 4*d.* : wages required;

therefore wages required $=\dfrac{215\times 28}{1}$ *d.* = £25. 1*s.* 8*d.*

(19) £204. 16*s.* : £179. 4*s.* :: £1 : sum paid in the £;

therefore sum paid in the £ $=\dfrac{3584\times 20}{4096}$ *s.* = 17*s.* 6*d.*

(20) 1 ton 8 cwt. 4 lbs. : 14 lbs. :: £98. 1 fl. 2 c. 5 m. : price required;
therefore price required $=\frac{14\times 98125}{3140}$ m. $=437\frac{1}{2}$ m. = 4 fl. 3 c. $7\frac{1}{2}$ m.

(21) 12*s.* 8*d.* : £950 :: £1 : amount of debts;
therefore amount required = £ $\frac{228000}{152}$ = £1500.

(22) $3\frac{1}{2}$ stone : 1 ton 4 cwt. 8 lbs. :: 6 fl. $1\frac{1}{4}$ c. : value required;
therefore value required $=\frac{2696\times 245}{49\times 4}$ c. = 3370 c. = £33. 7 fl.

(23) 26 yds. : 1 ft. :: 52*s.* : price per foot;
therefore price required $=\frac{52}{26\times 3}$ *s.* = 8*d.*

(24) 400 ac. 2 ro. 20 po. : 1 ac. :: £841. 3 fl. 1 c. $2\frac{1}{2}$ m. : rent per acre;
therefore rent per acre $=\frac{160\times 1682625}{64100\times 2}$ m. = 2100 m. = £2. 1 fl.

(25) 3 : 3·75 :: 40 : number required;
therefore number required $=\frac{3{\cdot}75\times 40}{3}=\frac{150}{3}=50.$

(26) 15 men : 10 men :: 12 days : days required;
therefore days required $=\frac{10\times 12}{15}=8.$

(27) 62 miles : 80 miles :: 3 days : days required;
therefore days required $=\frac{80\times 3}{62}=3{\cdot}8709\ldots\ldots$

(28) 3*s.* $7\frac{1}{2}$*d.* : 18*s.* $1\frac{1}{2}$*d.* :: $935\frac{1}{2}$ yds. : yards required;
therefore number of yards required $=\frac{870\times 1871}{174\times 2}=4677\frac{1}{2}.$

(29) Loss on £1 debt = 4 fl. 2 c. 5 m.;
therefore £1 : £11793. 5 fl. :: 425 m. : loss required;
therefore loss $=\frac{117935\times 425}{10}$ m. = £5012. 2 fl. 3 c. $7\frac{1}{2}$m.

(30) $2\frac{1}{2}$ lbs. : 2 tons 16 cwt. 17 lbs. :: 10*d.* : price required;
therefore price required $=\frac{6289\times 10\times 2}{5}$ *d.* = £104. 16*s.* 4*d.*

(31) 16 hrs. : 12 hrs. :: 24 days : days required;
therefore days required $=\frac{24\times 12}{16}=18.$

(32) $3\frac{5}{9}$ oz. : $(30\frac{3}{7} \times 16)$ oz. :: 7*s.* : value required;

therefore value required $= \dfrac{9 \times 3408 \times 7}{32 \times 7}\,s. = £47.\ 18s.\ 6d.$

(33) 15 days : 24 days :: 5 men : number of men required;

therefore number of men $= \dfrac{24 \times 5}{15} = 8.$

(34) 356 ac. 3 ro. $39\frac{1}{2}$ po. : 2 ac. :: £951. 19*s.* 10*d.* : rent required;

therefore rent required $= \dfrac{2 \times 320 \times 228478}{114239}\,d. = 1280d. = £5.\ 6s.\ 8d.$

(35) £2514. 7*s.* 6*d.* : £1 :: £83. 16*s.* 3*d.* : rate required;

therefore rate $= \dfrac{8 \times 20115}{20115}\,d. = 8d.$

and £1 : £115. 12*s.* 6*d.* :: 8*d.* : rate required;

therefore rate $= \dfrac{925 \times 8}{8}\,d. = £3.\ 17s.\ 1d.$

(36) 27 bus. 2 pks. : $16\frac{1}{2}$ bus. :: £10. 7*s.* $2\frac{1}{4}$*d.* : price required;

therefore price required $= \dfrac{2 \times 33 \times 9945}{55 \times 2}\,q. = £6.\ 4s.\ 3\frac{3}{4}d.$

(37) 5 qrs. : 3 qrs. :: 40 yds. : number of yards required;

therefore yards required $= \dfrac{3 \times 40}{5} = 24.$

(38) £910 : £420 :: $6\frac{1}{2}$ mo. : number of months required;

therefore number of months $= \dfrac{420 \times 13}{910 \times 2} = 3.$

(39) Area of field $= (121 \times 86)$ sq. yds.;
therefore 4840 yds. : (121×86) yds. :: £80 : price required;

therefore price required $= £\,\dfrac{121 \times 86 \times 80}{4840} = £172.$

(40) 1 lb. : ·75 cwt. :: ·5625 fl. : price required,
and ·75 cwt. $= \frac{3}{4}$ of 1 cwt. $= 84$ lbs.;
therefore price $= (84 \times {}^{\cdot}5625)$ fl. $= £4.$ 7 fl. 2 c. 5 m.

(41) $3\frac{1}{2} : 28\frac{3}{4}$ :: £11. 5*s.* : price required;

therefore price required $= \dfrac{2 \times 115 \times 225}{7 \times 4}\,s. = £92.\ 8s.\ 2\frac{4}{7}d.$

(42) £12. 7*s.* $11\frac{5}{8}$*d.* : £3. 19*s.* $0\frac{3}{4}$*d.* :: $34\frac{1}{2}$ yds. : number of yards required

therefore number of yards required $= \dfrac{3795 \times 69}{23805 \times 4 \times 2} = 11.$

(43) Area of field $=(50\cdot4\times56\cdot25)$ sq. chains $=2835$ sq. chains $=283\cdot5$ ac.;

therefore 1 ac. : 283·5 ac. :: 30*s.* : rent required,

$$\text{rent required}=(283\cdot5\times30)s.=£425.\ 5s.$$

(44) 25 men : 12 men :: 3 days : days required;

$$\text{therefore days required}=\frac{12\times3}{25}=1\tfrac{11}{25}.$$

(45) $\cdot3$ of 4·5 cwt. $=\frac{1}{3}$ of 4·5 cwt. $=1\cdot5$ cwt. $=168$ lbs.;

therefore 168 lbs. : 1 lb. :: 1155 c. : price required;

$$\text{therefore price required}=\frac{1155}{168}\text{ c.}=6\tfrac{7}{8}\text{ c.}=6\text{ c. }8\tfrac{3}{4}\text{ m.}$$

(46) £3. 17*s.* $10\frac{1}{2}d.$: £150 :: 1 oz. : number of oz. in the piece of gold;

$$\text{therefore weight of the piece of gold}=\frac{36000}{934\frac{1}{2}}\text{ oz.}$$

$$\text{Again, 12 oz.} : \frac{36000}{934\frac{1}{2}}\text{ oz.} :: 54s.\ 6d. : \text{value of silver;}$$

$$\text{therefore value required}=\frac{36000\times654\times2}{12\times1869}d.=£8.\ 14s.\ 11\tfrac{1}{2}d.\ \tfrac{46}{623}q.$$

(47) $375\frac{1}{2}\times75\frac{1}{2} : 278\frac{3}{4}\times151$ :: £118. 2*s.* $6\frac{1}{4}d.$: value required;

therefore price required

$$=\frac{278\frac{3}{4}\times151\times113401}{375\frac{1}{2}\times75\frac{1}{2}}q.=\frac{1115\times151\times113401}{751\times151}q.=£175.\ 7s.\ 7\tfrac{1}{4}d.$$

(48) Number of days from Jan. 1 to May 27 $=146$;

therefore 365 : 146 :: 35 guineas : wages required;

$$\text{therefore wages required}=\frac{146\times35}{365}\text{ guineas}=£14.\ 14s.$$

(49) $$\tfrac{3}{11}\text{ of }\tfrac{2}{9}\text{ of }\tfrac{4}{17} : \frac{1\frac{2}{8}}{4\frac{1}{4}}\text{ of }\tfrac{2}{5} :: £\frac{400}{33} : \text{value required;}$$

$$\text{therefore value required}=£\frac{11\times9\times17\times5\times4\times2\times400}{3\times2\times4\times4\times17\times5\times33}=£100.$$

(50) 48 yds. : 60 yds. :: 7*s.* 3*d.* : price required;

$$\text{therefore price required}=\frac{60\times87}{48}d.=9s.\ 0\tfrac{3}{4}d.$$

(51) 19*s.* 5*d.* : £1 :: £1632. 18*s.* 10*d.* : income required;

$$\text{therefore income}=£\frac{391906}{233}=£1682.$$

(52) £1 : £3150 :: 17*s.* $2\frac{1}{2}d.$: income required;

therefore income $=(3150\times826)q.=£2710.\ 6s.\ 3d.$

(53) From noon on Monday to 10 hrs. 15 min. A.M. on Saturday th are $118\frac{1}{4}$ hrs.; therefore 24 : $118\frac{1}{4}$ :: 3′ 10″ : gain required;

$$\text{therefore gain} = \frac{473 \times 190}{24 \times 4}\ \text{sec.} = 15'\ 36\tfrac{7}{48}'';$$

therefore time indicated by the watch will be

$$10\ \text{hrs.}\ 15' + 15'\ 36\tfrac{7}{48}'' + 10',\ \text{or}\ 10\ \text{hrs.}\ 40'\ 36\tfrac{7}{48}''.$$

(54) 1 : 3·1416 :: $22\frac{1}{2}$ ft. : circumference required;

$$\text{therefore circumference required} = \left(3{\cdot}1416 \times \frac{45}{2}\right)\text{ft.} = 70\ \text{ft.}\ 8{\cdot}232$$

(55) £937. 10*s.* : £1 :: £455. 1*s.* $6\frac{3}{4}$*d.* : amount required;

$$\text{therefore amount} = \frac{20 \times 436875}{18750}\,q. = 9s.\ 8\tfrac{1}{2}d.,$$

and £1 : £114 :: 10*s.* $3\frac{1}{2}$*d.* : loss on £114;

$$\text{therefore loss} = (114 \times 494)q. = £58.\ 13s.\ 3d.$$

(56) $25\frac{3}{4}$: 40 :: 3 cwt. : weight required;

$$\text{therefore weight required} = \frac{4 \times 40 \times 3}{103}\ \text{cwt.} = 4\tfrac{68}{103}\ \text{cwt.}$$

(57) 14 : 365 :: £21 : annual expenditure;

$$\text{therefore annual expenditure} = £\,\frac{365 \times 21}{14} = £547.\ 10s.;$$

therefore income must be £747. 10*s.*

(58) 175 guineas : £120 :: £6. 17*s.* $9\frac{3}{4}$*d.* : tax required;

$$\text{therefore tax} = \frac{2400 \times 6615}{3675}\,q. = £4.\ 10s.$$

(59) 1 lb. 10 oz. 10 dwts. : 1 oz. :: £6. 3*s.* 9*d.* : price required;

$$\text{price per oz.} = \frac{20 \times 1485}{450}\,d. = 5s.\ 6d.$$

(60) $4\frac{1}{2}$ days : 9 days :: $7\frac{1}{2}$ hrs. : number of hours required;

$$\text{therefore number of hours} = \frac{9 \times 15 \times 2}{9 \times 2} = 15.$$

(61) Cost of silver when manufactured will be

(£3. 6*s.* + 18*s.* + £1. 2*s.*), or £5. 6*s.* per lb.;

therefore 1 lb. : 7 lbs. 7 oz. 10 dwts. :: £5. 6*s.* : price required;

$$\text{therefore price required} = \frac{1830 \times 106}{240}\,s. = £40.\ 8s.\ 3d.$$

(62) 365 : 63 :: £818 + £94. 10*s.* : sum required;

$$\text{therefore sum required} = \frac{63 \times 18250}{365}\,s. = £157.\ 10s.$$

(63) Since 1 man = 3 boys and 1 woman = 2 boys, the question is the same as the following: if (45 + 24 + 9) boys do the work in 50 days, in what time will (27 + 30 + 18) boys do 4 times as much?

therefore 75 : 78 :: 50 days : days required for same work;

$$\text{therefore days required for same work} = \frac{78 \times 50}{75} = 52;$$

therefore days required to do 4 times as much = 208.

(64) Tax = £40; therefore he has £721. 7 f. 5 c. to spend annually;

therefore 365 : 1 :: £721. 7 f. 5 c. : daily expenditure;

$$\text{therefore sum required} = \frac{72175}{365}\,\text{m.} = £1.\ 9\,\text{f.}\ 5\,\text{c.}$$

(65) Since 3 cows eat as much as 7 horses,

$$7 \text{ cows eat as much as } \frac{49}{3} \text{ horses};$$

$$\text{therefore } 3 + \frac{49}{3} : 7 :: 29 : \text{days required};$$

$$\text{therefore days} = \frac{3 \times 7 \times 29}{58} = 10\tfrac{1}{2}.$$

(66) $\text{Area of room} = \frac{440}{9}\,\text{sq. yds.};$

$$\text{therefore } \frac{3}{4}\,\text{sq. yd.} : \frac{440}{9}\,\text{sq. yds.} :: 1\,\text{yd.} : \text{number of yards required};$$

$$\text{therefore number of yards required} = \frac{4 \times 440}{3 \times 9} = 65\tfrac{5}{27}.$$

(67) Cost of eggs = $(50 + 33\tfrac{1}{3})d. = 83\tfrac{1}{3}d.$,

also 5 : 200 :: 2*d.* : selling price;

$$\text{therefore eggs are sold for } \frac{200 \times 2}{5}\,d. = 80d.;\ \text{therefore loss is } 3\tfrac{1}{3}d.$$

(68) From 12 P.M. on Saturday till 12 A.M. on Tuesday are 60 hours, and till 4 P.M. Thursday the clock will indicate 112 hours;

therefore 60 hrs. 3 min. : 112 hrs. :: 3 min. : gain on true time;

$$\text{therefore gain on true time} = \frac{60 \times 112 \times 3}{3603}\,\text{min.} = 5\tfrac{715}{1201}\,\text{min.}$$

therefore true time will be $5\tfrac{715}{1201}$ min. before 4.

(69) 19*s.* 2*d.* : £1 :: £728. 6*s.* 8*d.* : sum required;

$$\text{therefore sum required} = £\frac{240 \times 2185}{230 \times 3} = £760.$$

(70) In 12 days $\frac{12}{50}$ of the work is done, and the remaining 19 men have $\frac{38}{50}$ of the work to finish. Also 19 men do $\frac{19}{50 \times 35}$ of the work daily;

$$\text{therefore } \frac{19}{50 \times 35} : \frac{38}{50} :: 1 \text{ day} : \text{days required};$$

$$\text{therefore days required} = \frac{50 \times 35 \times 38}{19 \times 50} = 70.$$

(71) Number of square yards in 1000 coats $= 1000 \times 2\frac{1}{2} \times 1\frac{1}{4}$;

$\therefore \frac{3}{4}$ sq. yd. : $\left(1000 \times \frac{5}{2} \times \frac{5}{4}\right)$ sq. yds. :: 1 yd. : number of yds. required;

therefore number of yards required $= \frac{4 \times 1000 \times 5 \times 5}{3 \times 2 \times 4} = 4166\frac{2}{3}$.

(72) $2\frac{1}{2}$ fur. : 240000 miles :: 5 oz. : weight required;

therefore weight required $= \frac{240000 \times 5 \times 2 \times 8}{5}$ oz.

$= (240000 \times 16)$ oz. $= 240000$ lbs.

(73) $(3 \times 3{\cdot}1416)$ ft. : 4 miles :: 1 : number of revolutions;

therefore number of revolutions $= \frac{4 \times 1760 \times 3}{3 \times 3{\cdot}1416} = 2240\frac{320}{357}$.

(74) 8 oz. : ·75 ton :: ·5625*s.* : price required;

therefore price required $= \frac{15 \times 112 \times 16 \times {\cdot}5625}{8}$ *s.*

$= (3360 \times {\cdot}5625)$*s.* $=$ £94. 10*s.*

(75) $\cdot458\dot{3}$*s.* : £61. 12*s.* :: ·0625 lbs. : weight required;

therefore weight required $= \frac{9000 \times 1232 \times {\cdot}0625}{4125}$ lbs. $= 168$ lbs.

(76) 4′ 10″ : 60′ :: 1 day : number of days required;

therefore number of days $= \frac{3600}{250} = 14$ days 9 hrs. 36 min.;

therefore the time will be on Monday fortnight at 6 hrs. 36 min. P.M.

(77) $(2{\cdot}5 \times 3)$ sq. ft. : (20×27) sq. ft. :: 1 yd. : number of yards required;

$$\text{therefore number of yards} = \frac{20 \times 27}{7{\cdot}5} = 72.$$

(78) 960 galls. : 1 gall. :: £640 : price required;

$$\text{therefore price required} = £\frac{640}{960} = 13s.\ 4d.$$

(79) A soldier's daily allowance $= \frac{12}{8}$ lbs. $= 1\frac{1}{2}$ lbs.;

therefore 1 : 366 :: $\left(850 \times \frac{3}{2}\right)$ lbs. : weight required;

$$\text{therefore weight required} = \frac{366 \times 2550}{2}\text{ lbs.} = 466650\text{ lbs.}$$

(80) 1600 men will have provision enough for 2000 men for 80 days; therefore 1600 : 2000 :: 80 days : number of days required;

$$\text{therefore number of days} = \frac{2000 \times 80}{1600} = 100.$$

(81) 20 sq. poles : (10000 × 160) sq. poles :: $(1\frac{1}{2} \times 52)d.$: yearly income;

$$\text{therefore yearly income} = \frac{10000 \times 160 \times 3 \times 52}{20 \times 2}d. = £26000.$$

(82) 1 oz. : $\cdot 3682291\dot{6}$ lbs. :: $£4\cdot 18958\dot{3}$: value required;
therefore value required

$$= £\frac{12 \times 33140625 \times 3770625}{90000000 \times 900000} = £\frac{2011 \times 707}{40 \times 1920} = £18.\ 10s.\ 3\tfrac{17}{320}d.$$

(83) 850 men will have enough provisions to last 1000 men for 68 days;
therefore 850 : 1000 :: 68 days : time required;

$$\text{therefore time required} = \frac{1000 \times 68}{850}\text{ days} = 80\text{ days.}$$

(84) 1 ac. : $182\cdot\dot{3}$ ac. :: $£\frac{4\cdot 65}{4}$: rent required;

$$\text{therefore rent required} = £\frac{547 \times 4\cdot 65}{3 \times 4} = £211.\ 19s.\ 3d.$$

(85) £120 + £2. 10*s.* + £61. 5*s.* = £183. 15*s.*;
therefore 2 tons 3 cwt. 3 qrs. : 1 cwt. :: £183. 15*s.* : price required;

$$\text{therefore price per cwt.} = \frac{4 \times 3675}{175}s. = £4.\ 4s.$$

(86) Area of piece $= (2 \times 14\frac{5}{8} \times 13\frac{2}{13})$ sq. yds.;
therefore

$40\frac{1}{2}$ sq. yds. : $\left(2 \times \frac{117}{8} \times \frac{171}{13}\right)$ sq. yds. :: 1 yd. : number of yards required;

$$\text{therefore number of yards} = \frac{2 \times 117 \times 171 \times 2}{81 \times 8 \times 13} = 9\tfrac{1}{2}.$$

(87) 3·75 yds. = 60 nails, and 38 yds. 2 qrs. 3 nails = 619 nails;

therefore 60 : 619 :: £3·825 : price required;

$$\text{therefore price} = £\frac{619 \times 3{\cdot}825}{60} = £39.\ 9s.\ 2\tfrac{1}{2}d.\ \tfrac{4}{5}q.$$

(88) 1 cow eats as much as $\frac{9}{7}$ horses, 9 cows eat as much as $\frac{81}{7}$ horses;

therefore $4 + \frac{54}{7} : 18 + \frac{81}{7}$ :: 1 : relative size of second field;

therefore size of second field $= \frac{7 \times 207}{82 \times 7} = \frac{207}{82}$ size of first field.

(89) *A* reaps $\frac{1}{55}$, and *B* $\frac{1}{66}$ in one hour;

therefore together they reap $\frac{1}{55} + \frac{1}{66}$, or $\frac{1}{30}$ in 1 hour;

therefore $\frac{10}{30}$: 1 :: 1 day : days required; ∴ days required $= \frac{30}{10} = 3.$

DOUBLE RULE OF THREE.

Ex. LVII. (p. 224.)

(1) $$\left.\begin{array}{r} 6\text{ ac.} : 15\text{ ac.} \\ 14\text{ hrs.} : 12\text{ hrs.} \end{array}\right\} :: 7\text{ men} : \text{number of men required;}$$

$$\text{therefore number of men} = \frac{7 \times 15 \times 12}{6 \times 14} = 15.$$

(2) $$\left.\begin{array}{r} £15 : 15\text{ gui.} \\ 9\text{ days} : 20\text{ days} \end{array}\right\} :: 3\text{ men} : \text{number of men required;}$$

$$\text{therefore number of men} = \frac{20 \times 315 \times 3}{9 \times 300} = 7.$$

(3) $$\left.\begin{array}{r} 7\text{ horses} : 16\text{ horses} \\ 96\text{ bus.} : 66\text{ bus.} \end{array}\right\} :: 42\text{ days} : \text{number of days required;}$$

$$\text{therefore number of days} = \frac{66 \times 16 \times 42}{7 \times 96} = 66.$$

(4) $$\left.\begin{array}{r} 5\text{ sacks} : 15\text{ sacks} \\ 2\text{ days} : 6\text{ days} \end{array}\right\} :: 800\text{ soldiers} : \text{number of soldiers required;}$$

$$\text{therefore number required} = \frac{15 \times 6 \times 800}{2 \times 5} = 7200.$$

(5)
$$\left.\begin{array}{r}6\text{ horses} : 8\text{ horses}\\ 13\text{ days} : 11\text{ days}\end{array}\right\} :: 17\text{ bus.} : \text{number of bushels required};$$
$$\text{therefore number of bushels} = \frac{11 \times 8 \times 17}{6 \times 13} = 19\tfrac{7}{39}.$$

(6)
$$\left.\begin{array}{r}16\text{ horses} : 12\text{ horses}\\ 8\text{ days} : 5\text{ days}\end{array}\right\} :: 1280\text{ ac.} : \text{number of acres required};$$
$$\text{therefore number of acres} = \frac{5 \times 12 \times 1280}{16 \times 8} = 600.$$

(7)
$$\left.\begin{array}{r}36\text{ cwt. }23\text{ lbs.} : 11\text{ cwt.}\\ \pounds1.\ 5\text{ c.} : \pounds5.\ 2\text{ f. }5\text{ c.}\end{array}\right\} :: 12\text{ miles} : \text{miles required};$$
$$\text{therefore number of miles} = \frac{11 \times 112 \times 525 \times 12}{105 \times 4055} = 18\tfrac{186}{811}.$$

(8)
$$\left.\begin{array}{r}53\text{ miles} : 124\text{ miles}\\ 6\text{ gui.} : 3\text{ gui.}\end{array}\right\} :: 8\text{ cwt.} : \text{number of cwt. required};$$
$$\text{therefore number of cwt.} = \frac{3 \times 124 \times 8}{53 \times 6} = 9\tfrac{19}{53}.$$

(9)
$$\left.\begin{array}{r}5\text{ men} : 7\text{ men}\\ 11\text{ mo.} : 4\text{ mo.}\end{array}\right\} :: \pounds641\tfrac{2}{3} : \text{sum required};$$
$$\text{therefore sum required} = \pounds\frac{7 \times 4 \times 1925}{5 \times 11 \times 3} = \pounds326.\ 13s.\ 4d.$$

(10)
$$\left.\begin{array}{r}\pounds225 : \pounds1000\\ \pounds100 : \pounds49\tfrac{1}{2}\end{array}\right\} :: 5\text{ mo.} : \text{number of months required};$$
$$\text{therefore months required} = \frac{1000 \times 495 \times 5}{225 \times 1000} = 11.$$

(11)
$$\left.\begin{array}{r}3\text{ horses} : 2\text{ horses}\\ 7\text{ mo.} : 11\text{ mo.}\end{array}\right\} :: \pounds59.\ 2s.\ 1\tfrac{1}{2}d. : \text{sum required};$$
$$\text{therefore sum required} = \frac{2 \times 11 \times 56742}{3 \times 7}q. = \pounds61.\ 18s.\ 5d.$$

(12)
$$\left.\begin{array}{r}100\text{ miles} : 160\text{ miles}\\ \pounds3.\ 8\text{ f. }5\text{ c.} : \pounds6.\ 0s.\ 3\tfrac{3}{4}d.\end{array}\right\} :: 4\tfrac{3}{4}\text{ cwt.} : \text{weight required};$$
$$\therefore \text{weight required} = \frac{160 \times 6015{\cdot}625 \times 19}{100 \times 3850}\text{ qrs.} = 11\text{ cwt. }3\text{ qrs. }14\text{ lbs.}$$

(13)
$$\left.\begin{array}{r}7\text{ men} : 1\text{ man}\\ 345\tfrac{5}{7}\text{ sq. yds.} : 6\text{ ac.}\end{array}\right\} :: 1\text{ hr.} : \text{hours required};$$
$$\text{therefore number of hours required} = \frac{6 \times 4840}{7 \times \dfrac{2420}{7}} = 12.$$

(14)
$$\left.\begin{array}{r}12\text{ men} : 20\text{ men}\\ \pounds90 : \pounds150\end{array}\right\} :: 3\text{ weeks} : \text{number of weeks required};$$
$$\text{therefore number of weeks} = \frac{20 \times 150 \times 3}{12 \times 90} = 8\tfrac{1}{3}.$$

(15)
$$\left.\begin{array}{r}\text{1 cwt. 3 qrs. 21 lbs.} : 2\tfrac{1}{2}\text{ tons}\\ 52\tfrac{1}{4}\text{ miles} : 46\tfrac{1}{2}\text{ miles}\end{array}\right\} :: 17s.\ 5d. : \text{cost required};$$
$$\text{therefore cost required} = \frac{5\times 2240\times 93\times 209\times 4}{2\times 2\times 217\times 209}\,d. = \pounds 20.$$

(16)
$$\left.\begin{array}{r}\text{8 men} : \text{10 men}\\ 7\tfrac{1}{2}\text{ ac.} : \text{9 ac.}\end{array}\right\} :: \text{36 hrs.} : \text{number of hours required};$$
$$\text{therefore number of hours} = \frac{10\times 9\times 36\times 2}{8\times 15} = 54;$$
$$\text{therefore number of days} = \frac{54}{16} = \text{3 days 6 hrs.}$$

(17)
$$\left.\begin{array}{r}\text{30 men} : \text{25 men}\\ \text{16 days} : \text{24 days}\end{array}\right\} :: \text{8 hrs.} : \text{number of hours required};$$
$$\text{therefore number of hours} = \frac{8\times 25\times 24}{30\times 16} = 10.$$

(18)
$$\left.\begin{array}{r}\text{17 ac. 3 ro. 2 po.} : \text{26 ac. 2 ro. 23 po.}\\ \text{7 ac.} : \text{6 ac.}\end{array}\right\} :: \pounds 39.\ 4s.\ 7d. : \text{rent required};$$
$$\text{therefore rent required} = \frac{4263\times 6\times 9415}{7\times 2842}\,d. = \pounds 50.\ 8s.\ 9d.$$

(19)
$$\left.\begin{array}{r}\text{1500 copies} : \text{5000 copies}\\ \text{11 sheets} : \text{25 sheets}\end{array}\right\} :: \text{66 reams} : \text{number of reams required};$$
$$\text{therefore number of reams} = \frac{5000\times 25\times 66}{11\times 1500} = 500.$$

(20)
$$\left.\begin{array}{r}\text{7 men} : \text{5 men}\\ \text{12 hrs.} : \text{14 hrs.}\\ \text{800 ft.} : \text{1800 ft.}\\ \text{700 ft.} : \text{960 ft.}\end{array}\right\} :: 3\tfrac{1}{2}\text{ days} : \text{number of days required};$$
$$\text{therefore number of days} = \frac{5\times 14\times 1800\times 960\times 7}{7\times 12\times 800\times 700\times 2} = 9.$$

(21)
$$\left.\begin{array}{r}\text{1500 men} : \text{1000 men}\\ 6\tfrac{2}{3}\text{ oz.} : \text{16 oz.}\end{array}\right\} :: \text{5 wks.} : \text{number of weeks required};$$
$$\text{therefore number of weeks} = \frac{1000\times 16\times 5\times 3}{1500\times 20} = 8.$$

(22)
$$\left.\begin{array}{r}\text{60 masons} : \text{20 masons}\\ \text{10 hrs.} : \text{7 hrs.}\\ \text{50 ft.} : \text{500 ft.}\\ \text{2 ft.} : \text{4 ft.}\\ \text{14 ft.} : \text{16 ft.}\end{array}\right\} :: \text{12 days} : \text{number of days required};$$
$$\text{therefore number of days} = \frac{20\times 7\times 500\times 4\times 16\times 12}{60\times 10\times 50\times 2\times 14} = 64.$$

(23) $$\left.\begin{array}{r}\frac{24}{5}\text{ days} : 24\text{ days}\\ 1\text{ day} : 7\text{ days}\end{array}\right\} :: 10\text{ men} : \text{number of men required;}$$

$$\text{therefore number of men} = \frac{24 \times 7 \times 10 \times 5}{24} = 350.$$

(24) $$\left.\begin{array}{r}100\text{ yds.} : 1000\text{ yds.}\\ 20\text{ ft.} : 16\text{ ft.}\\ 4\text{ ft.} : 6\text{ ft.}\\ 30\text{ hrs.} : 48\text{ hrs.}\end{array}\right\} :: 125\text{ men} : \text{number of men required;}$$

$$\text{therefore number of men} = \frac{1000 \times 16 \times 6 \times 48 \times 125}{100 \times 20 \times 4 \times 30} = 2400.$$

(25) $$\left.\begin{array}{r}5\text{ ft.} : 12\tfrac{1}{2}\text{ ft.}\\ 3\tfrac{3}{4}\text{ ft.} : 6\tfrac{1}{2}\text{ ft.}\\ 2\tfrac{1}{2}\text{ ft.} : 8\tfrac{1}{4}\text{ ft.}\end{array}\right\} :: 7500\text{ lbs.} : \text{weight required;}$$

$$\text{therefore weight required} = \frac{25 \times 13 \times 33 \times 2 \times 4 \times 7500}{2 \times 2 \times 4 \times 5 \times 15 \times 5}\text{ lbs.}$$
$$= 47\text{ tons } 17\text{ cwt. } 66\text{ lbs.}$$

(26) $$\left.\begin{array}{r}£20 : £72\\ 5s. : 4\tfrac{1}{2}s.\end{array}\right\} :: 100\text{ men} : \text{men required;}$$

$$\text{therefore number of men} = \frac{72 \times 9 \times 100}{2 \times 5 \times 20} = 324.$$

(27) Here 25 horses eat as much as 40 ponies. Also for £41. 5*s.* we can buy at 22*s.* a quarter, $\frac{825}{22}$ qrs., or $\frac{75}{2}$ qrs.;

$$\left.\begin{array}{r}\text{therefore } 40\text{ ponies} : 12\text{ ponies}\\ 15\text{ qrs.} : \frac{75}{2}\text{ qrs.}\end{array}\right\} :: 64\text{ days} : \text{number of days required;}$$

$$\text{therefore number of days} = \frac{12 \times 75 \times 64}{40 \times 15 \times 2} = 48.$$

(28) $$\left.\begin{array}{r}42\tfrac{1}{2}\text{ yds.} : 118\tfrac{1}{4}\text{ yds.}\\ 18\text{ in.} : 36\text{ in.}\end{array}\right\} :: £59.\ 14s.\ 2d. : \text{cost required;}$$

$$\text{therefore cost} = \frac{473 \times 36 \times 2 \times 14330}{4 \times 85 \times 18}\,d. = £332.\ 5s.\ 2\tfrac{4}{17}d.$$

(29) $$\left.\begin{array}{r}124\text{ men} : 62\text{ men}\\ 55\text{ hrs.} : 63\text{ hrs.}\end{array}\right\} :: (110 \times 3 \times 3 \times 4)\text{ cub. ft.} : \text{number of cub. ft. required;}$$

$$\text{therefore number of cub. ft.} = \frac{110 \times 3 \times 3 \times 4 \times 62 \times 63}{55 \times 124} = 2268.$$

(30)
$$\left.\begin{array}{r}3\cdot35\text{ lbs.} : 47\cdot5\text{ lbs.}\\ 4\cdot75s. : 13\cdot4s.\end{array}\right\} :: 4d. : \text{price required};$$

$$\text{therefore price required} = \frac{47\cdot5\times13\cdot4\times4}{3\cdot35\times4\cdot75}d.$$

$$= \frac{475\times134\times4\times100}{335\times475}d. = 13s.\ 4d.$$

(31)
$$\left.\begin{array}{r}63\text{ ft.} : 14\text{ ft.}\\ £3 : £4\tfrac{1}{2}\end{array}\right\} :: 24\text{ ft.} : \text{number of feet required};$$

$$\text{therefore number of feet} = \frac{14\times9\times24}{63\times3\times2} = 8.$$

(32)
$$\left.\begin{array}{r}24\text{ in.} : 27\text{ in.}\\ 4\tfrac{1}{2}d. : 4d.\end{array}\right\} :: £2.\ 3s.\ 1\tfrac{1}{2}d. : \text{cost required};$$

$$\text{therefore cost} = \frac{(£2.\ 3s.\ 1\tfrac{1}{2}d.)\times27\times4\times2}{24\times9} = £2.\ 3s.\ 1\tfrac{1}{2}d.$$

(33)
$$\left.\begin{array}{r}7\text{ men} : 4\text{ men}\\ 16\text{ days} : 42\text{ days}\end{array}\right\} :: 880\text{ yds.} : \text{number of yards required};$$

$$\text{therefore number of yards} = \frac{880\times4\times42}{7\times16} = 1320.$$

(34)
$$\left.\begin{array}{r}3\tfrac{1}{4}\text{ ft.} : 2\tfrac{1}{4}\text{ ft.}\\ 7\tfrac{1}{2}\text{ in.} : 8\text{ in.}\\ 1280\text{ lbs.} : 2028\text{ lbs.}\end{array}\right\} :: 16\text{ ft.} : \text{number of feet required};$$

$$\text{therefore number of feet} = \frac{9\times8\times2028\times16\times2\times4}{13\times15\times1280\times4} = 18\tfrac{18}{25}.$$

(35) Here 12 oxen eat as much as 28 sheep,

9 oxen . . . . 21 sheep;

$$\therefore \left.\begin{array}{r}(28+35)\text{ sheep} : (21+12)\text{ sheep}\\ 8\text{ days} : 28\text{ days}\end{array}\right\} :: (12\tfrac{3}{5}\times4)\text{ gui.} : \text{cost required};$$

$$\text{therefore cost} = \frac{33\times28\times63\times4}{63\times8\times5}\text{ gui.} = £97.\ 0s.\ 4\tfrac{4}{5}d.$$

(36) Here 1 man does $\frac{3}{2}$ of a woman's work;

$$\therefore \left.\begin{array}{r}(3+1)\text{ women} : (\tfrac{3}{2}+2)\text{ women}\\ 1\text{ woman} : 4\text{ women}\end{array}\right\} :: 10\text{ days} : \text{number of days required};$$

$$\text{therefore number of days} = \frac{7\times4\times10}{4\times2} = 35.$$

(37)
$$\left.\begin{array}{r}142\cdot2\text{ miles} : 505\cdot6\text{ miles}\\ 8\cdot4\text{ hrs.} : 10\cdot164\text{ hrs.}\end{array}\right\} :: 4\tfrac{1}{2}\text{ days} : \text{number of days required};$$

$$\text{therefore number of days} = \frac{505\cdot6\times10\cdot164\times9}{8\cdot4\times142\cdot2} = 19\cdot36.$$

(38) $\left.\begin{matrix} \frac{1}{2}s. : 18\frac{2}{15}s. \\ 18\frac{2}{5}s. : 5\frac{3}{4}s. \end{matrix}\right\}$ :: $4\frac{7}{20}$ lbs. : number of lbs. required;

therefore number of lbs. $= \frac{272 \times 23 \times 87 \times 5 \times 2}{20 \times 92 \times 15 \times 4} = \frac{29 \times 17}{10} = 49{\cdot}3.$

(39) $\left.\begin{matrix} 9 \text{ people} : 8 \text{ people} \\ 12 \text{ mo.} : 7 \text{ mo.} \\ 5 : 3 \end{matrix}\right\}$ :: $(1560 \times 21)s.$: cost in shillings;

therefore cost $= \frac{8 \times 7 \times 3 \times 1560 \times 21}{9 \times 12 \times 5} s. = £509.\ 12s.$

SIMPLE INTEREST.

Ex. LVIII. (p. 230.)

1. (1)
£
85
5
£4·25
20
5·00*s*.

(2)
£
310
4
£12·40
20
8·00*s*.

(3)
£
1000
4½
4000
500
£45·00

(4)
£
475
5
£23·75
20
15·00*s*.

and £23. 15*s*. × 3 = £71. 5*s*.

(5)
£ . *s*. . *d*.
936 . 11 . 3
4
37·46 . 5 . 0
20
9·25*s*.
12
3·00*d*.

£ . *s*. . *d*.
and 37 . 9 . 3
2
£74 . 18 . 6

(6)
£ . *s*. . *d*.
556 . 13 . 4
5
27·83 . 6 . 8
20
16·66*s*.
12
8·00*d*.

£ . *s*. . *d*.
and 27 . 16 . 8
6
£167 . 0 . 0

(7)
£ . *s*. . *d*.
945 . 10 . 0
4
37·82 . 0 . 0
20
16·40*s*.
12
4·80*d*.
4
3·20*q*.

£ . *s*. . *d*. *q*.
and 37 . 16 . 4¾ ⅕
2
Ans. £75 . 12 . 9½ ⅖

(8)
£ . *s*. . *d*.
198 . 6 . 8
3½
595 . 0 . 0
99 . 3 . 4
6·94 . 3 . 4
20
18·83*s*.
12
10·00*d*.

£ *s.* *d.*
(9) 236 . 6 . 8
3
7·09 . 0 . 0
20
1·80*s.*
12
9·60*d.*
4
2·40*q.*

£ *s.* *d.* *q.*
and 7 . 1 . $9\frac{1}{2}$ $\frac{2}{5}$
$2\frac{1}{2}$
14 . 3 . 7 $\frac{4}{5}$
3 . 10 . $10\frac{3}{4}$ $\frac{1}{5}$
£17 . 14 . 6

£ *s.* *d.*
(10) 98 . 15 . 10
$2\frac{1}{2}$
197 . 11 . 8
49 . 7 . 11
2·46 . 19 . 7
20
9·39*s.*
12
4·75*d.*
4
3·00*q.*

£ *s.* *d.* *q.*
and 2 . 9 . $4\frac{3}{4}$
$\frac{1}{2}$
£1 . 4 . $8\frac{1}{4}$ $\frac{1}{2}$

£ *s.* *d.*
2. (1) 1000 . 0 . 0
$4\frac{1}{4}$
4000 . 0 . 0
250 . 0 . 0
42·50 . 0 . 0
20
10·00*s.*

£ *s.*
42 . 10
2
85 . 0 interest
1000 . 0 principal
1085 . 0 amount.

£ *s.* *d.*
(2) 2833 . 6 . 8
3
£85·00 . 0 . 0

£ *s.* *d.*
85 . 0 . 0
$4\frac{1}{2}$
340 . 0 . 0
42 . 10 . 0
382 . 10 . 0
2833 . 6 . 8
Amount £3215 . 16 . 8

m.
(3) 1050625
$4\frac{1}{4}$
4202500
$262656\frac{1}{4}$
$44651·56\frac{1}{4}$ interest for 1 year
6
$267909·37\frac{1}{2}$ interest for 6 years
1050625· principal
1318534·375 amount.

Ans. £1318. 5 f. 3 c. $4\frac{3}{8}$ m.

(4)

$$\begin{array}{rrr} \pounds & s. & d. \\ 139\,. & 12\,. & 6 \\ & & 5\frac{1}{2} \\ \hline 698\,. & 2\,. & 6 \\ 69\,. & 16\,. & 3 \\ \hline 7{\cdot}67\,. & 18\,. & 9 \\ 20 & & \\ \hline 13{\cdot}58\,s. & & \\ 12 & & \\ \hline 7{\cdot}05\,d. & & \\ 4 & & \\ \hline {\cdot}20\,q. & & \end{array}
\qquad
\begin{array}{rrrr} \pounds & s. & d. & q. \\ 7\,. & 13\,. & 7 & \frac{1}{5} \\ & & & 3\frac{1}{2} \\ \hline 23\,. & 0\,. & 9 & \frac{3}{5} \\ 3\,. & 16\,. & 9\frac{1}{2} & \frac{1}{10} \\ \hline 26\,. & 17\,. & 6\frac{1}{2} & \frac{7}{10} \\ 139\,. & 12\,. & 6 & \\ \hline \pounds166\,. & 10\,. & 0\frac{1}{2} & \frac{7}{10} \end{array}$$

(5)

$$\begin{array}{rrr} \pounds & s. & d. \\ 1989\,. & 15\,. & 0 \\ & & 2\frac{3}{4} \\ \hline 3979\,. & 10\,. & 0 \\ 994\,. & 17\,. & 6 \\ 497\,. & 8\,. & 9 \\ \hline 54{\cdot}71\,. & 16\,. & 3 \\ 20 & & \\ \hline 14{\cdot}36\,s. & & \\ 12 & & \\ \hline 4{\cdot}35\,d. & & \\ 4 & & \\ \hline 1{\cdot}40\,q. & & \end{array}
\qquad
\begin{array}{rrrr} \pounds & s. & d. & q. \\ 54\,. & 14\,. & 4\frac{1}{4} & \frac{2}{5} \\ & & & 4\frac{3}{4} \\ \hline 218\,. & 17\,. & 5\frac{1}{4} & \frac{3}{5} \\ 27\,. & 7\,. & 2 & \frac{7}{10} \\ 13\,. & 13\,. & 7 & \frac{7}{20} \\ \hline 259\,. & 18\,. & 2\frac{1}{2} & \frac{13}{20} \\ 1989\,. & 15\,. & 0 & \\ \hline \pounds2249\,. & 13\,. & 2\frac{1}{2} & \frac{13}{20} \end{array}$$

(6)

$$\begin{array}{rrr} \pounds & s. & d. \\ 1534\,. & 6\,. & 3 \\ & & 3\frac{1}{4} \\ \hline 4602\,. & 18\,. & 9 \\ 383\,. & 11\,. & 6\frac{3}{4} \\ \hline 49{\cdot}86\,. & 10\,. & 3\frac{3}{4} \\ 20 & & \\ \hline 17{\cdot}30\,s. & & \\ 12 & & \\ \hline 3{\cdot}63\,d. & & \\ 4 & & \\ \hline 2{\cdot}55\,q. & & \end{array}
\qquad
\begin{array}{rrrr} \pounds & s. & d. & q. \\ 49\,. & 17\,. & 3\frac{1}{2} & \frac{11}{20} \\ & & & 1\frac{5}{8} \\ \hline 49\,. & 17\,. & 3\frac{1}{2} & \frac{11}{20} \\ 24\,. & 18\,. & 7\frac{3}{4} & \frac{11}{40} \\ 6\,. & 4\,. & 7\frac{3}{4} & \frac{131}{160} \\ \hline 81\,. & 0\,. & 7\frac{1}{4} & \frac{103}{160} \\ 1534\,. & 6\,. & 3\,. & \\ \hline \pounds1615\,. & 6\,. & 10\frac{1}{4} & \frac{103}{160} \end{array}$$

(7)

$$\begin{array}{rrr} \pounds & s. & d. \\ 411\,. & 10\,. & 0 \\ & & 4\frac{7}{8} \\ \hline 1646\,. & 0\,. & 0 \\ 360\,. & 1\,. & 3 \\ \hline 20{\cdot}06\,. & 1\,. & 3 \\ 20 & & \\ \hline 1{\cdot}21\,s. & & \\ 12 & & \\ \hline 2{\cdot}55\,d. & & \\ 4 & & \\ \hline 2{\cdot}20\,q. & & \end{array}
\qquad
\begin{array}{rrrr} \pounds & s. & d. & q. \\ 20\,. & 1\,. & 2\frac{1}{2} & \frac{1}{5} \\ & & & \frac{1}{4} \\ \hline 5\,. & 0\,. & 3\frac{1}{2} & \frac{11}{20} \\ 411\,. & 10\,. & 0 & \\ \hline \pounds416\,. & 10\,. & 3\frac{1}{2} & \frac{11}{20} \end{array}$$

(8)
m.
1595125
$3\frac{3}{4}$
4785375
$797562\frac{1}{2}$
$398781\frac{1}{4}$
$59817{\cdot}18\frac{3}{4}$ interest for 1 year
$5\frac{3}{4}$
$29908593\frac{3}{4}$
$2990859\frac{3}{8}$
$1495429\frac{11}{16}$
$343948{\cdot}82\frac{13}{16}$ interest for $5\frac{3}{4}$ years
1595125
$1939073{\cdot}82\frac{13}{16}$

therefore amount = £1939. 0 f. 7 c. 3·828125 m.

3. (1)
£ . *s.*
375 . 0
$3\frac{1}{2}$
1125 . 0
187 . 10
13·12 . 10
20
2·50 *s.*
12
6·00 *d.*

£ . *s.* . *d.*
13 . 2 . 6
$3\frac{2}{3}$
39 . 7 . 6
8 . 15 . 0
48 . 2 . 6 interest
375 . 0 . 0
£423 . 2 . 6 amount.

(2)
£ . *s.*
446 . 10
5
22·32 . 10
20
6·50 *s.*
12
6·00 *d.*

£ . *s.* . *d.*
22 . 6 . 6
$3\frac{1}{4}$
66 . 19 . 6
5 . 11 . $7\frac{1}{2}$
72 . 11 . $1\frac{1}{2}$ interest
446 . 10 . 0
£519 . 1 . $1\frac{1}{2}$ amount.

(3)
£
220
$3\frac{3}{4}$
660
165
8·25
20
5·00 *s.*

£ . *s.* . *d.*
8 . 5 . 0
7
12 | 57 . 15 . 0
4 . 16 . 3 interest
220 . 0 . 0
£224 . 16 . 3 amount.

(4)

$$\begin{array}{rcrcl}
\pounds & & s. & & d. \\
243 & . & 10 & . & 0 \\
 & & & & 4\frac{3}{4} \\ \hline
974 & . & 0 & . & 0 \\
121 & . & 15 & . & 0 \\
60 & . & 17 & . & 6 \\ \hline
11{\cdot}56 & . & 12 & . & 6 \\
20 & & & & \\ \hline
11{\cdot}32s. & & & & \\
12 & & & & \\ \hline
3{\cdot}90d. & & & & \\
4 & & & & \\ \hline
3{\cdot}60q. & & & &
\end{array}
\qquad
\begin{array}{rcrcll}
\pounds & & s. & & d.\ \ q. & \\
11 & . & 11 & . & 3\frac{3}{4}\ \frac{3}{5} & \\
 & & & & 2 & \\ \hline
23 & . & 2 & . & 7\frac{3}{4}\ \frac{1}{5} & \\
3 & . & 17 & . & 1\frac{1}{4}\ \frac{1}{5} & \text{for 4 months} \\
0 & . & 19 & . & 3\frac{1}{4}\ \frac{3}{10} & \text{for 1 month} \\ \hline
27 & . & 19 & . & 0\frac{1}{4}\ \frac{7}{10} & \text{interest} \\
243 & . & 10 & . & 0 & \\ \hline
\pounds 271 & . & 9 & . & 0\frac{1}{4}\ \frac{7}{10} & \text{amount.}
\end{array}$$

(5)

$$\begin{array}{rcl}
\pounds & & s. \\
10 & . & 10 \\
 & & 3\frac{1}{2} \\ \hline
31 & . & 10 \\
5 & . & 5 \\ \hline
{\cdot}36 & . & 15 \\
20 & & \\ \hline
7{\cdot}35s. & & \\
12 & & \\ \hline
4{\cdot}20d. & &
\end{array}$$

therefore interest required $= \frac{117}{365}$ of 7*s.* $4\frac{1}{5}$*d.*

$$= \frac{117 \times 441}{365 \times 5} d.$$

$$= 2s.\ 4\tfrac{497}{1825} d.,$$

and amount $=$ £10. 12*s.* $4\frac{497}{1825}$*d.*

(6)

$$\begin{array}{rcrcl}
\pounds & & s. & & d. \\
684 & . & 18 & . & 8 \\
 & & & & 4\frac{1}{8} \\ \hline
2739 & . & 14 & . & 8 \\
85 & . & 12 & . & 4 \\ \hline
28{\cdot}25 & . & 7 & . & 0 \\
20 & & & & \\ \hline
5{\cdot}07s. & & & & \\
12 & & & & \\ \hline
{\cdot}84d. & & & &
\end{array}
\qquad
\begin{array}{r|rcrcll}
 & \pounds & & s. & & d. & \\
 & 28 & . & 5 & . & 0\frac{21}{25} & \\
 & & & & & 11 & \\ \hline
12 & 310 & . & 15 & . & 9\frac{6}{25} & \\ \hline
 & 25 & . & 17 & . & 11\frac{77}{100} & \\
 & 28 & . & 5 & . & 0\frac{21}{25} & \\ \hline
 & 54 & . & 3 & . & 0\frac{61}{100} & \text{interest} \\
 & 684 & . & 18 & . & 8 & \\ \hline
 & \pounds 739 & . & 1 & . & 8\frac{61}{100} & \text{amount.}
\end{array}$$

(7)

$$\begin{array}{rcl}
\pounds & & s. \\
42 & . & 0 \\
 & & 3\frac{1}{8} \\ \hline
126 & . & 0 \\
5 & . & 5 \\ \hline
1{\cdot}31 & . & 5 \\
20 & & \\ \hline
6{\cdot}25s. & & \\
12 & & \\ \hline
3{\cdot}00d. & &
\end{array}$$

Now, from March 16, 1850 to Jan. 23, 1851, there were 313 days;

therefore interest required $= \frac{313}{365}$ of £1. 6*s.* 3*d.*

$= $ £1. 2*s.* $6\frac{9}{73}$*d.*,

and amount $=$ £43. 2*s.* $6\frac{9}{73}$*d.*

(8)

$$\begin{array}{rrr}
\pounds & s. & d. \\
320\ . & 15\ . & 0 \\
 & & 4\frac{3}{4} \\ \hline
1283\ . & 0\ . & 0 \\
240\ . & 11\ . & 3 \\ \hline
15{\cdot}23\ . & 11\ . & 3 \\
20 & & \\ \hline
4{\cdot}71s. & & \\
12 & & \\ \hline
8{\cdot}55d. & & \\
4 & & \\ \hline
2{\cdot}20q. & &
\end{array}$$

Now interest for

35 days $= \frac{35}{365}$ of £15. 4*s*. $8\frac{1}{2}$*d*. $\frac{1}{5}$*q*.

$= $ £1. 9*s*. $2\frac{1}{2}$*d*. $\frac{187}{365}$*q*.;

$$\begin{array}{rrrrl}
 & \pounds & s. & d. & q. \\
\therefore & 15\ . & 4\ . & 8\frac{1}{2} & \frac{1}{5} \\
 & & & 2 & \\ \hline
 & 30\ . & 9\ . & 5 & \frac{2}{5} \quad \text{interest for 2 years} \\
 & 1\ . & 9\ . & 2\frac{1}{2} & \frac{187}{365} \quad \text{for 35 days} \\ \hline
 & 31\ . & 18\ . & 7\frac{1}{2} & \frac{333}{365} \quad \text{interest} \\
 & 320\ . & 15\ . & 0 & \\ \hline
 & \pounds 352\ . & 13\ . & 7\frac{1}{2} & \frac{333}{365} \quad \text{amount.}
\end{array}$$

(9)

$$\begin{array}{rr}
\pounds & d. \\
34\ . & 10 \\
 & 4\frac{1}{2} \\ \hline
138\ . & 0 \\
17\ . & 5 \\ \hline
1{\cdot}55\ . & 5 \\
20 & \\ \hline
11{\cdot}05s. & \\
12 & \\ \hline
{\cdot}60d. & \\
4 & \\ \hline
2{\cdot}40q. &
\end{array}$$

Now from Aug. 10 to Oct. 21 there are 72 days; therefore interest required

$= \frac{72}{365}$ of £1. 11*s*. $0\frac{1}{2}$*d*. $\frac{2}{5}$*q*.

$= 6$*s*. $1\frac{1}{4}$*d*. $\frac{1819}{1825}$*q*.;

therefore amount $=$ £34. 16*s*. $1\frac{1}{4}$*d*. $\frac{1819}{1825}$*q*.

4.

$$\begin{array}{rrr}
\pounds & s. & d. \\
715\ . & 12\ . & 6 \\
 & & 4\frac{1}{2} \\ \hline
2862\ . & 10\ . & 0 \\
357\ . & 16\ . & 3 \\ \hline
32{\cdot}20\ . & 6\ . & 3 \\
20 & & \\ \hline
4{\cdot}06s. & & \\
12 & & \\ \hline
0{\cdot}75d. & & \\
4 & & \\ \hline
3{\cdot}00q. & &
\end{array}$$

therefore brokerage $=$ £32. 4*s*. $0\frac{3}{4}$*d*.

5.

$$\begin{array}{r}
\pounds \\
4000 \\
\frac{1}{2} \\ \hline
\pounds 20{\cdot}00
\end{array}$$

therefore insurance $=$ £20.

6. £$95\frac{1}{2}$: £1910 :: £100 : sum required;

therefore sum required $= \pounds\,\dfrac{1910 \times 100 \times 2}{191} = \pounds 2000.$

7. £$92\frac{1}{2}$: £525 :: £100 : sum required;

therefore sum required $= \pounds\,\dfrac{525 \times 100 \times 2}{185} = \pounds 567.\ 11s.\ 4\frac{8}{37}d.$

Ex. LIX. (p. 232.)

(1) £120 : £150. 8*s.* :: £100 : sum required;

therefore sum required $= £\,\dfrac{752 \times 100}{5 \times 120} = £125.\ 6s.\ 8d.$

(2) £540 : £100 :: ⅑ of £194. 8*s.* : rate required;

therefore rate required $= £\,\dfrac{100 \times 972}{540 \times 9 \times 5} = £4.$

(3) Interest on £350 for 1 year = £10. 5 f.;

therefore £10. 5 f. : £52. 5 f. :: 1 year : time required;

therefore time required $= \dfrac{525}{105}$ years = 5 years.

(4) Interest for 1 year = ²⁄₇ of £48. 9*s.* 4¼*d.* = £13. 16*s.* 11½*d.*;

therefore £325. 16*s.* 8*d.* : £100 :: £13. 16*s.* 11½*d.* : rate required;

therefore rate required $= £\,\dfrac{100 \times 13294}{78200 \times 4} = £4\tfrac{1}{4}.$

(5) Interest on £142. 10*s.* for 1 year = £4. 19*s.* 9*d.*;

therefore £4. 19*s.* 9*d.* : £84. 15*s.* 9*d.* :: 1 year : time required;

therefore time required $= \dfrac{20349}{1197}$ years = 17 years.

(6) £157. 15*s.* 4*d.* : £100 :: ¹⁄₂₅ of £138. 0*s.* 11*d.* : rate required;

therefore rate required $= £\,\dfrac{100 \times 33131}{37864 \times 25} = £3\tfrac{1}{2}.$

(7) £4½ : £25⅕ :: £100 : sum required;

therefore sum required $= £\,\dfrac{126 \times 100 \times 2}{5 \times 9} = £560.$

(8) £100 amounts in 3½ years to £114⅞;

therefore £114⅞ : £105. 6*s.* 0½*d.* :: £100 : sum required;

therefore sum required $= £\,\dfrac{101090 \times 100}{110280} = £91.\ 13s.\ 4d.$

(9) £112 : £387. 7*s*. 7½*d*. :: £100 : sum required;

$$\text{therefore sum required} = £\frac{464856 \times 100}{26880 \times 5} = £345.\ 17s.\ 6d.$$

(10) Interest on £1275 for 1 year = £48. 9*s*.;

therefore £48. 9*s*. : £274. 11*s*. :: 1 year : time required;

$$\text{therefore time required} = \frac{5491}{969}\text{ years} = 5\tfrac{2}{3}\text{ years.}$$

(11) £936. 13*s*. 4*d*. : £100 :: $\frac{8}{39}$ of £220. 14*s*. 0½*d*. : rate required;

$$\text{therefore rate required} = £\frac{100 \times 211874 \times 8}{224800 \times 39} = £4\tfrac{5}{8}.$$

(12) Interest on £125 for 1 year = £6. 5*s*.;

therefore £6. 5*s*. : £125 :: 1 year : time required;

$$\text{therefore time required} = \frac{125 \times 20}{125}\text{ years} = 20\text{ years.}$$

(13) £100 in 10 years amounts to £135;

therefore £135 : £100 :: £425. 19*s*. 4⅘*d*. : sum required;

$$\text{therefore sum required} = \frac{100 \times 34077\frac{3}{5}}{135}\,q. = £315.\ 10s.\ 8d.$$

Again, interest on £315. 10*s*. 8*d*. for 1 year, at 3½ per cent., will be £11. 0*s*. 10·48*d*.,

and £453. 11*s*. 7*d*.—£425. 19*s*. 4⅘*d*.

= £27. 12*s*. 2⅕*d*. the interest to be acquired;

therefore £11. 0*s*. 10·48*d*. : £27. 12*s*. 2·2*d*. :: 1 year : time required;

$$\text{therefore time required} = \frac{6626{\cdot}2}{2650{\cdot}48}\text{ years} = 2\tfrac{1}{2}\text{ years.}$$

(14) Interest on £250 for 1 year = £7. 10*s*.;

therefore interest on £250 will amount in 6 years to £45.

Again, £100 in 4 years, at 5 per cent., will acquire £20 interest;

therefore £20 : £45 :: £100 : sum required;

$$\text{therefore sum required} = £\frac{45 \times 100}{20} = £225.$$

COMPOUND INTEREST.

Ex. LX. (p. 235.)

(1)
£
2000
4
£80·00

£
2080
4
83·20
20
4·00 s.

£ s.
80 . 0 interest for 1st year
83 . 4 interest for 2nd year
£163 . 4 interest required.

(2)
£
800 = 1st principal
3¾
2400
600
£30·00

£ s. d.
830 . 0 . 0
31 . 2 . 6
861 . 2 . 6 = 3rd principal
3¾
2583 . 7 . 6
645 . 16 . 10½
32·29 . 4 . 4½
20
5·84 s.
12
10·12 d.
4
·50 q.

£ s.
830 . 0 = 2nd principal
3¾
2490 . 0
622 . 10
31·12 . 10
20
2·50 s.
12
6·00 d.

£ s. d.
861 . 2 . 6
32 . 5 . 10⅛
£893 . 8 . 4⅛ = amount.

(3)
£
270 = 1st principal
3
8·10
20
2·00 s.

£ s. d. q.
8 . 2 . 0
8 . 6 . $10\frac{1}{4}\frac{7}{25}$
£16 . 8 . $10\frac{1}{4}\frac{7}{25}$ = interest required.

£ s.
278 . 2 = 2nd principal
3
8·34 . 6
20
6·86 s.
12
10·32 d.
4
1·28 q.

(4)

$$\begin{array}{rl}
\pounds & \\
690 & =\text{1st principal}\\
4\frac{1}{2} & \\ \hline
2760 & \\
345 & \\ \hline
31{\cdot}05 & \\
20 & \\ \hline
1{\cdot}00\,s. &
\end{array}$$

$$\begin{array}{rcrcrl}
\pounds & & s. & & d. & \\
721 & . & 1 & . & 0 & =\text{2nd principal}\\
 & & & & 4\frac{1}{2} & \\ \hline
2884 & . & 4 & . & 0 & \\
360 & . & 10 & . & 6 & \\ \hline
32{\cdot}44 & . & 14 & . & 6 & \\
20 & & & & & \\ \hline
8{\cdot}94\,s. & & & & & \\
12 & & & & & \\ \hline
11{\cdot}34\,d. & & & & &
\end{array}$$

$$\begin{array}{rcrcrl}
\pounds & & s. & & d. & \\
721 & . & 1 & . & 0 & \\
32 & . & 8 & . & 11{\cdot}34 & \\ \hline
753 & . & 9 & . & 11{\cdot}34 & =\text{3rd principal}\\
 & & & & 4\frac{1}{2} & \\ \hline
3013 & . & 19 & . & 9{\cdot}36 & \\
376 & . & 14 & . & 11{\cdot}67 & \\ \hline
33{\cdot}90 & . & 14 & . & 9{\cdot}03 & \\
20 & & & & & \\ \hline
18{\cdot}14\,s. & & & & & \\
12 & & & & & \\ \hline
1{\cdot}7703\,d. & & & & &
\end{array}$$

$$\begin{array}{rcrcrl}
\pounds & & s. & & d. & \\
753 & . & 9 & . & 11{\cdot}34 & \\
33 & . & 18 & . & 1{\cdot}7703 & \\ \hline
\pounds 787 & . & 8 & . & 1{\cdot}1103 & =\text{amount.}
\end{array}$$

(5)

$$\begin{array}{rcrl}
\pounds & & s. & \\
230 & . & 15 & =\text{1st principal}\\
 & & 5 & \\ \hline
11{\cdot}53 & . & 15 & \\
20 & & & \\ \hline
10{\cdot}75\,s. & & & \\
12 & & & \\ \hline
9{\cdot}00\,d. & & &
\end{array}$$

$$\begin{array}{rcrcrl}
\pounds & & s. & & d. & \\
242 & . & 5 & . & 9 & =\text{2nd principal}\\
 & & & & 5 & \\ \hline
12{\cdot}11 & . & 8 & . & 9 & \\
20 & & & & & \\ \hline
2{\cdot}28\,s. & & & & & \\
12 & & & & & \\ \hline
3{\cdot}45\,d. & & & & & \\
4 & & & & & \\ \hline
1{\cdot}80\,q. & & & & &
\end{array}$$

$$\begin{array}{rcrcrrl}
\pounds & & s. & & d. & q. & \\
242 & . & 5 & . & 9 & & \\
12 & . & 2 & . & 3\frac{1}{4} & \frac{4}{5} & \\ \hline
254 & . & 8 & . & 0\frac{1}{4} & \frac{4}{5} & =\text{3rd principal}\\
 & & & & & 5 & \\ \hline
12{\cdot}72 & . & 0 & . & 2\frac{1}{4} & & \\
20 & & & & & & \\ \hline
14{\cdot}40\,s. & & & & & & \\
12 & & & & & & \\ \hline
4{\cdot}82\,d. & & & & & & \\
4 & & & & & & \\ \hline
3{\cdot}29\,q. & & & & & &
\end{array}$$

$$\begin{array}{rcrcrrl}
\pounds & & s. & & d. & q. & \\
254 & . & 8 & . & 0\frac{1}{4} & \frac{4}{5} & \\
12 & . & 14 & . & 4\frac{3}{4} & \frac{29}{100} & \\ \hline
\pounds 267 & . & 2 & . & 5\frac{1}{4} & \frac{9}{100} & =\text{amount.}
\end{array}$$

(6)
£ . s. . d.
415 . 10 . 0
2¼
831 . 0 . 0
103 . 17 . 6
9·34 . 17 . 6
20
6·97*s.*
12
11·70*d.*

£ . s. . d.
434 . 8 . 1·88325 = 3rd principal
2¼
868 . 16 . 3·7665
108 . 12 . 0·4708125
9·77 . 8 . 4·2373125
20
15·48*s.*
12
5·802373125*d.*

£ . s. . d.
9 . 6 . 11·7
4
£37 . 7 . 10·8 = simple interest.

£ . s. . d.
424 . 16 . 11·7 = 2nd principal
2¼
849 . 13 . 11·4
106 . 4 . 2·925
9·55 . 18 . 2·325
20
11·18*s.*
12
2·18325*d.*

£ . s. . d.
444 . 3 . 7·685623125 = 4th principal
2¼
888 . 7 . 3·37124625
111 . 0 . 10·92140578125
9·99 . 8 . 2·29265203125
20
19·88*s.*
12
10·5829265203125*d.*

£ . s. . d.
therefore 9 . 6 . 11·7
9 . 11 . 2·18325
9 . 15 . 5·802373125
9 . 19 . 10·5829265203125
compound interest = 38 . 13 . 6·2685496453125
simple interest = 37 . 7 . 10·8
£1 . 5 . 7·4685496453125

= £1. 5*s.* 7½*d.* nearly.

(7)
£ . . £
1st payment = 130 $\times \frac{2}{100} =$ 2·6
2nd .... = 132·6 $\times \frac{2}{100} =$ 2·652
3rd .... = 135·252 $\times \frac{2}{100} =$ 2·70504
4th .... = 137·95704 $\times \frac{2}{100} =$ 2·7591408
5th .... = 140·7161808 $\times \frac{2}{100} =$ 2·814323616
6th .... = 143·530504416 $\times \frac{2}{100} =$ 2·87061008832
therefore compound interest = 16·40111450432
20
8·02229008640*s.*
12
·26748103680*d.*

Ans. £16. 8*s.* 0¼*d.* nearly.

(8)
£ . s.
1760 . 10 = 1st principal
4
70·42 . 0
20
8·40*s.*
12
4·80*d.*

£ . s. . d.
1930 . 18 . 4·8 = 2nd principal
4
73·23 . 13 . 7·2
20
4·73*s.*
12
8·832*d.*

£ . s. . d.
1904 . 3 . 1·632 = 3rd principal
2
38·08 . 6 . 3·264
20
1·66*s.*
12
7·95264*d.*

£ . s. . d.
1904 . 3 . 1·632
38 . 1 . 7·95264
Ans. £1942 . 4 . 9·58464

(9)
£
230
3½
690
115
8·05
20
1·00*s.*

£ . s. . d.
230 . 0 . 0
230 . 0 . 0
8 . 1 . 0
468 . 1 . 0
3½
1404 . 3 . 0
234 . 0 . 6
16·38 . 3 . 6
20
7·68*s.*
12
7·62*d.*

£ . s. . d.
468 . 1 . 0
230 . 0 . 0
16 . 7 . 7·62
Ans. £714 . 8 . 7·62

(10)
£ . s. . d.
416 . 13 . 4
2¼
833 . 6 . 8
104 . 3 . 4
9·37 . 10 . 0
20
7·50*s.*
12
6·00*d.*

£ . s. . d.
9 . 7 . 6
2
£18 . 15 . 0 = simple interest.

£ . s. . d.
426 . 0 . 10 = 2nd principal
2¼
852 . 1 . 8
106 . 10 . 2½
9·58 . 11 . 10½
20
11·71*s.*
12
8·62*d.*
4
2·50*q.*

£ . s. . d. . q.
9 . 7 . 6
9 . 11 . 8½ ½
18 . 19 . 2½ ½ = comp. interest
18 . 15 . 0 = simple interest
0 . 4 . 2½ ½ = difference.

(11)

£ s. d.
13333 . 6 . 8 = 1st principal
5
666·66 . 13 . 4
20
13·33s.
12
4·00d.

£ s. d.
666 . 13 . 4
5
£3333 . 6 . 8 = simple interest.

£
14000 = 2nd principal
5
£700·00

£
14700 = 3rd principal
5
£735·00

£
15435 = 4th principal
5
771·75
20
15·00s.

£ s.
16206 . 15 = 5th principal
5
810·33 . 15
20
6·75s.
12
9·00d.

£ s. d.
therefore compound interest = 3683 . 15 . 1
simple interest = 3333 . 6 . 8
difference = 350 . 8 . 5

(12)

£
180 = 1st principal
4½
720
90
8·10
20
2·00s.

£ s.
188 . 2 = 2nd principal
4½
752 . 8
94 . 1
8·46 . 9
20
9·29s.
12
3·48d.

£ s. d.
196 . 11 . 3·48 = 3rd principal
4½
786 . 5 . 1·92
98 . 5 . 7·74
8·84 . 10 . 9·66
20
16·90s.
12
10·8966d.

£ s. d.
196 . 11 . 3·48
8 . 16 . 10·8966
£205 . 8 . 2·3766 = amount required.

(13) £100, at compound interest, will amount in 2 years to £110. 5*s.*;
therefore £110¼ : £100 :: £100 : sum required;

$$\text{therefore sum required} = \pounds\,\frac{100\times 100\times 4}{441} = \pounds 90.\ 14\tfrac{26}{441}s.$$

(14) £100, at compound interest, will amount in 2 years to £110. 5*s.*;
therefore £110¼ : £100 :: £264⅝ : sum required;

$$\text{therefore sum required} = \pounds\,\frac{100\times 1323\times 4}{5\times 441} = \pounds 240.$$

(15)

$$\begin{array}{r} \pounds \\ 256 \\ 4\frac{1}{2} \\ \hline 1024 \\ 128 \\ \hline 11{\cdot}52 \\ 20 \\ \hline 10{\cdot}40s. \\ 12 \\ \hline 4{\cdot}80d. \end{array} \qquad \begin{array}{rcrcrl} \pounds & & s. & & d. & \\ 11 & . & 10 & . & 4{\cdot}8 & \\ & & & & 3 & \\ \hline \pounds 34 & . & 11 & . & 2{\cdot}4 & \text{simple interest.} \end{array}$$

$$\begin{array}{rcrcrl} \pounds & & s. & & d. & \\ 267 & . & 10 & . & 4{\cdot}8 & =\text{2nd principal} \\ & & & & 4\frac{1}{2} & \\ \hline 1070 & . & 1 & . & 7{\cdot}2 & \\ 133 & . & 15 & . & 2{\cdot}4 & \\ \hline 12{\cdot}03 & . & 16 & . & 9{\cdot}6 & \\ 20 & & & & & \\ \hline 0{\cdot}76s. & & & & & \\ 12 & & & & & \\ \hline 9{\cdot}216d. & & & & & \end{array} \qquad \begin{array}{rcrcrl} \pounds & & s. & & d. & \\ 279 & . & 11 & . & 2{\cdot}016 & =\text{3rd principal} \\ & & & & 4\frac{1}{2} & \\ \hline 1118 & . & 4 & . & 8{\cdot}064 & \\ 139 & . & 15 & . & 7{\cdot}008 & \\ \hline 12{\cdot}58 & . & 0 & . & 3{\cdot}072 & \\ 20 & & & & & \\ \hline 11{\cdot}60s. & & & & & \\ 12 & & & & & \\ \hline 7{\cdot}23072d. & & & & & \end{array}$$

$$\begin{array}{lrcrcrl} & \pounds & & s. & & d. & \\ \therefore & 36 & . & 2 & . & 9{\cdot}24672 & \text{compound interest} \\ & 34 & . & 11 & . & 2{\cdot}4 & \text{simple interest} \\ \hline & \pounds\,1 & . & 11 & . & 6{\cdot}84672 & \end{array} \qquad \begin{array}{r|l} \text{and } 12 & 6{\cdot}84672 \\ \hline 2{,}0 & 11{\cdot}57056 \\ \hline \textit{Ans.} & \pounds 1{\cdot}578528 \end{array}$$

DISCOUNT.

Ex. LXI. (p. 239.)

1. (1) £105 : £283. 10*s.* :: £100 : present worth;

$$\text{therefore present worth} = \pounds\,\frac{567\times 100}{105\times 2} = \pounds 270.$$

(2) £103. 5*s.* : £252. 19*s.* 3*d.* :: £100 : present worth;

$$\text{therefore present worth} = £\frac{60711 \times 100}{24780} = £245.$$

(3) £101$\frac{1}{2}$: £676$\frac{2}{3}$ :: £100 : present worth;

$$\text{therefore present worth} = £\frac{2030 \times 100 \times 2}{3 \times 203} = £666.\ 13s.\ 4d.$$

(4) £101$\frac{3}{4}$: £284$\frac{9}{10}$ :: £100 : present worth;

$$\text{therefore present worth} = £\frac{2849 \times 100 \times 4}{10 \times 407} = £280.$$

(5) £102$\frac{1}{3}$: £460$\frac{1}{2}$ :: £100 : present worth;

$$\text{therefore present worth} = £\frac{921 \times 100 \times 3}{2 \times 307} = £450.$$

(6) £101$\frac{43}{48}$: £390 :: £100 : present worth;

$$\text{therefore present worth} = £\frac{390 \times 100 \times 48}{4891} = £382.\ 14s.\ 10\tfrac{2522}{4891}d.$$

(7) £102$\frac{1}{2}$: £572 :: £100 : present worth;

$$\text{therefore present worth} = £\frac{572 \times 2 \times 100}{205} = £558.\ 0s.\ 11\tfrac{29}{41}d.$$

(8) £100$\frac{1}{12}$: £1261$\frac{1}{20}$ :: £100 : present worth;

$$\text{therefore present worth} = £\frac{25221 \times 100 \times 12}{1201 \times 20} = £1260.$$

(9) £101$\frac{1}{2}$: £35 :: £100 : present worth;

$$\text{therefore present worth} = £\frac{35 \times 100 \times 2}{203} = £34.\ 9s.\ 7\tfrac{25}{29}d.$$

(10) £100$\frac{7}{8}$: £1250 :: £100 : present worth;

$$\text{therefore present worth} = £\frac{1250 \times 100 \times 8}{807} = £1239.\ 3s.\ 1\tfrac{621}{807}d.$$

(11) £105$\frac{1}{2}$: £2110 :: £100 : present worth;

$$\text{therefore present worth} = £\frac{2110 \times 100 \times 2}{211} = £2000.$$

(12) £105 : £275$\frac{1}{3}$ :: £100 : present worth;

$$\text{therefore present worth} = £\frac{826 \times 100}{105 \times 3} = £262.\ 4s.\ 5\tfrac{1}{4}d.\ \tfrac{1}{3}q.$$

(13) £120 : £918 :: £100 : present worth;

$$\text{therefore present worth} = £\frac{918 \times 100}{120} = £765.$$

(14) £$108\frac{11}{96}$: £500 :: £100 : present worth;

$$\text{therefore present worth} = £\frac{500 \times 100 \times 96}{10379} = £462.\ 9s.\ 5\tfrac{3653}{10379}d.$$

(15) £210 : £840 :: £100 : present worth;

$$\text{therefore present worth} = £\frac{840 \times 100}{210} = £400.$$

(16) £112. 9*s*. 8·736*d*. : £2197 :: £100 : present worth;

therefore present worth

$$= £\frac{527280 \times 100}{26996{\cdot}736} = £\frac{527280 \times 100 \times 1000}{26996736} = £\frac{15625}{8} = £1953.\ 2s.\ 6d.$$

2. (1) £$101\frac{1}{3}$: £$63\frac{1}{3}$ :: £$1\frac{1}{3}$: discount;

$$\text{therefore discount} = £\frac{190 \times 4 \times 3}{304 \times 3 \times 3} = £\frac{5}{6} = 16s.\ 8d.$$

(2) £$102\frac{1}{4}$: £$1380\frac{3}{8}$ :: £$2\frac{1}{4}$: discount;

$$\text{therefore discount} = £\frac{11043 \times 9 \times 4}{409 \times 8 \times 4} = £30.\ 7s.\ 6d.$$

(3) £$102\frac{1}{2}$: £$107\frac{1}{4}$ :: £$2\frac{1}{2}$: discount;

$$\text{therefore discount} = £\frac{429 \times 5 \times 2}{205 \times 4 \times 2} = £2.\ 12s.\ 3\tfrac{33}{41}d.$$

(4) £$100\frac{7}{8}$: £$125\frac{1}{2}$ :: £$\frac{7}{8}$: discount;

$$\text{therefore discount} = £\frac{251 \times 7 \times 8}{2 \times 8 \times 807} = £1.\ 1s.\ 9\tfrac{213}{807}d.$$

(5) £$101\frac{11}{24}$: £487 :: £$1\frac{11}{24}$: discount;

$$\text{therefore discount} = £\frac{487 \times 35 \times 24}{24 \times 2435} = £7.$$

(6) £$101\frac{2}{3}$: £340 :: £$1\frac{2}{3}$: discount;

$$\text{therefore discount} = £\frac{340 \times 5 \times 3}{305 \times 3} = £5.\ 11s.\ 5\tfrac{43}{61}d.$$

(7) £104 : £3640 :: £4 : discount;

$$\text{therefore discount} = £\frac{3640 \times 4}{104} = £140.$$

(8) £$106\frac{1}{3}$: £$813\frac{9}{20}$ :: £$6\frac{1}{3}$; discount;

therefore discount = £$\dfrac{16269 \times 19 \times 3}{20 \times 3 \times 319}$ = £$\dfrac{969}{20}$ = £48. 9*s*.

(9) £$107\frac{1}{12}$: £$250\frac{3}{4}$ :: £$7\frac{1}{12}$: discount;

therefore discount = £$\dfrac{1003 \times 85 \times 12}{4 \times 12 \times 1285}$ = £16. 11*s*. $8\frac{200}{257}$*d*.

(10) £$101\frac{9}{10}$: £55 :: £$1\frac{9}{10}$: discount;

therefore discount = £$\dfrac{55 \times 19 \times 10}{1019 \times 10}$ = £1. 0*s*. $6\frac{126}{1019}$*d*.

(11) £100 : £649 :: £$1\frac{763}{1460}$: interest on £649;

therefore interest = £$\dfrac{649 \times 2223}{100 \times 1460}$ = £9. 17*s*. $7\frac{1106}{1825}$*d*.

Again, £$101\frac{763}{1460}$: £649 :: £$1\frac{763}{1460}$: discount;

therefore discount = £$\dfrac{649 \times 2223 \times 1460}{1460 \times 148223}$ = £9. 14*s*. $8\frac{5552}{148223}$*d*.

therefore banker's gain = 2*s*. 11*d*. nearly.

(12) £$100\frac{1127}{1460}$: £100 :: £$\frac{1127}{1460}$: discount;

therefore discount = £$\dfrac{112700 \times 1460}{147127 \times 1460}$ = 15*s*. $3\frac{123759}{147127}$*d*.

(13) £100 : £545 :: £7 : interest;

therefore interest = £$\dfrac{545 \times 7}{100}$ = £38. 3*s*.

Again, £107 : £$583\frac{3}{20}$ :: £7 : discount;

therefore discount = £$\dfrac{11663 \times 7}{20 \times 107}$ = £$\dfrac{763}{20}$ = £38. 3*s*.

(14) $\frac{1}{5}$ of the sum is the price of one volume at the end of a year, and $\frac{1}{6}$ of the sum is the present price;

therefore $\frac{1}{5} - \frac{1}{6} = \frac{1}{30}$ of given sum is the allowance made per volume;

therefore allowance on 5 volumes = $\frac{5}{30} = \frac{1}{6}$ of the sum;

therefore 1 : $\frac{1}{6}$ :: 100 : rate of discount;

therefore rate of discount = $\frac{100}{6} = 16\frac{2}{3}$ per cent.

(15) £105 : £100 :: £$2\frac{9}{20}$: cash price;

therefore cash price = £$\dfrac{100 \times 49}{100 \times 20}$ = £$\frac{7}{3}$ = £2. 6*s*. 8*d*.

STOCKS.

Ex. LXII. (p. 243.)

1. (1) £75 : £2850 :: £100 : stock required;

$$\text{therefore stock required} = £\frac{2850 \times 100}{75} = £3800.$$

(2) £89 : £712 :: £100 : stock required;

$$\text{therefore stock required} = £\frac{712 \times 100}{89} = £800.$$

(3) £96 : £504 :: £100 : stock required;

$$\text{therefore stock required} = £\frac{504 \times 100}{96} = £525.$$

(4) £93 : £883. 5 f. :: £100 : stock required;

$$\text{therefore stock required} = £\frac{8835 \times 100}{930} = £950.$$

(5) £87 : £3741 :: £100 : stock required;

$$\text{therefore stock required} = £\frac{3741 \times 100}{87} = £4300.$$

(6) £83$\frac{3}{4}$: £500 :: £100 : stock required;

$$\text{therefore stock required} = £\frac{500 \times 100 \times 4}{335} = £597.\ 0s.\ 3\tfrac{39}{67}d.$$

(7) £75$\frac{1}{2}$: £800 :: £100 : stock required;

$$\text{therefore stock required} = £\frac{800 \times 100 \times 2}{151} = £1059.\ 12\tfrac{8}{151}s.$$

(8) £85$\frac{3}{8}$: £4311. 8*s*. 9*d*. :: £100 : stock required;

$$\text{therefore stock required} = £\frac{1034745 \times 100}{20490} = £5050.$$

(9) £94 : £2100 :: £100 : stock required;

$$\text{therefore stock required} = £\frac{2100 \times 100}{94} = £2234\tfrac{2}{47}.$$

(10) £90$\frac{1}{2}$: £2353 :: £100 : stock required;

$$\text{therefore stock required} = £\frac{2353 \times 100 \times 2}{181} = £2600.$$

(11) £106 : £3277 :: £100 : stock required;

therefore stock required $=£\frac{3277\times 100}{106}=£3091.\ 10s.\ 2\frac{14}{53}d.$

(12) £$99\frac{3}{8}$: £10500 :: £100 : stock required;

therefore stock required $=£\frac{10500\times 100\times 8}{795}=£10566.\ 0s.\ 9\frac{3}{53}d.$

2. (1) £100 : £2600 :: £93 : value required;

therefore value required $=£\frac{2600\times 93}{100}=£2418.$

(2) £100 : £1920 :: £$77\frac{1}{2}$: value required;

therefore value required $=£\frac{1920\times 155}{100\times 2}=£1488.$

(3) £100 : £3000 :: £$92\frac{1}{2}$: value required;

therefore value required $=£\frac{3000\times 185}{100\times 2}=£2775.$

(4) £100 : £2240 :: £$81\frac{7}{8}$: value required;

therefore value required $=£\frac{2240\times 655}{100\times 8}=£1834.$

(5) £100 : £3416 :: £89 : value required;

therefore value required $=£\frac{3416\times 89}{100}=£3040.\ 4s.\ 9\frac{3}{5}d.$

(6) £100 : £1743 :: £$82\frac{7}{8}$: value required;

therefore value required $=£\frac{1743\times 663}{100\times 8}=£1444.\ 10s.\ 2\frac{1}{2}d.\ \frac{4}{5}q.$

(7) £100 : £2675 :: £$91\frac{3}{5}$: value required;

therefore value required $=£\frac{2675\times 458}{100\times 5}=£2450.\ 6s.$

(8) £100 : £1000 :: £$97\frac{1}{4}$: value required;

therefore value required $=£\frac{1000\times 389}{100\times 4}=£972.\ 10s.$

(9) £100 : £$2153\frac{1}{2}$ :: £$188\frac{3}{4}$: value required;

therefore value required $=£\frac{4307\times 755}{2\times 100\times 4}=£4064.\ 14s.\ 7\frac{1}{2}d.$

3. (1) £84 : £1008 :: £3 : income required;

$$\text{therefore income} = £\,\frac{1008 \times 3}{84} = £36.$$

(2) £93 : £5580 :: £4 : income required;

$$\text{therefore income} = £\,\frac{5580 \times 4}{93} = £240.$$

(3) £92 : £1138. 5 f. :: £4. 5 f. : income required;

$$\text{therefore income} = \frac{11385 \times 45}{920}\,\text{f.} = £55.\ 6\,\text{f.}\ 8\,\text{c.}\ 7\tfrac{1}{2}\,\text{m.}$$

(4) £93$\frac{3}{5}$: £1638 :: £4$\frac{1}{2}$: income required;

$$\text{therefore income} = £\,\frac{1638 \times 9 \times 5}{468 \times 2} = £78.\ 15s.$$

(5) £88$\frac{1}{2}$: £2000 :: £3 : income required;

$$\text{therefore income} = £\,\frac{2000 \times 3 \times 2}{177} = £67.\ 15s.\ 11\tfrac{11}{59}d.$$

(6) £91$\frac{3}{4}$: £3425. 15*s.* 2*d.* :: £3 : income required;

$$\text{therefore income} = \frac{822182 \times 3}{22020}\,d. = £112.\ 0s.\ 3\tfrac{123}{367}d.$$

(7) £105 : £4788 :: £3$\frac{1}{2}$: income required;

$$\text{therefore income} = £\,\frac{4788 \times 7}{105 \times 2} = £159.\ 12s.$$

(8) £94$\frac{1}{4}$: £3500 :: £3 : income required;

$$\text{therefore income} = £\,\frac{3500 \times 3 \times 4}{377} = £111.\ 8s.\ 1\tfrac{151}{377}d.$$

(9) £102$\frac{19}{24}$: £5250 :: £3$\frac{1}{2}$: income required;

$$\text{therefore income} = £\,\frac{5250 \times 7 \times 24}{2 \times 2467} = £178.\ 15s.\ 2\tfrac{766}{2467}d.$$

4. (1) £3 : £60 :: £85 : sum required;

$$\text{therefore sum required} = £\,\frac{60 \times 85}{3} = £1700.$$

(2) £3 : £67 :: £288 : sum required;

$$\text{therefore sum required} = £\,\frac{288 \times 67}{3} = £6432.$$

(3) £$3\frac{1}{2}$: £70 :: £90 : sum required;

$$\text{therefore sum required} = £\frac{90 \times 70 \times 2}{7} = £1800.$$

(4) £4. 5f. : £83. 2f. 5c. :: £94 : sum required;

$$\text{therefore sum required} = £\frac{8325 \times 94}{450} = £1739.$$

(5) £3 : £87 :: £$74\frac{5}{8}$: sum required;

$$\text{therefore sum required} = £\frac{87 \times 597}{3 \times 8} = £2164.\ 2s.\ 6d.$$

(6) £4 : £$37\frac{1}{2}$ :: £$93\frac{3}{8}$: sum required;

$$\text{therefore sum required} = £\frac{75 \times 747}{4 \times 2 \times 8} = £875.\ 7s.\ 9\frac{3}{4}d.$$

5. (1) £91 : £100 :: £3 : interest required;

$$\text{therefore interest} = £\frac{3 \times 100}{91} = £3.\ 5s.\ 11\frac{19}{91}d.$$

(2) £94 : £100 :: £$3\frac{1}{2}$: interest required;

$$\text{therefore interest} = £\frac{100 \times 7}{94 \times 2} = £3.\ 14s.\ 5\frac{29}{47}d.$$

(3) £$96\frac{5}{8}$: £100 :: £$4\frac{1}{2}$: interest required;

$$\text{therefore interest} = £\frac{100 \times 9 \times 8}{773 \times 2} = £4.\ 13s.\ 1\frac{559}{773}d.$$

(4) £103 : £100 :: £5 : interest required;

$$\text{therefore interest} = £\frac{100 \times 5}{103} = £4.\ 17s.\ 1\frac{5}{103}d.$$

6. £$94\frac{3}{8}$: £$7927\frac{1}{2}$ :: £2. 18s. 3d. : net income;

$$\text{therefore net income} = \frac{15855 \times 699 \times 8}{2 \times 755}\,d. = £244.\ 13s.$$

7. £90 : £100 :: £3 : rate per cent.; therefore rate per cent. = £$3\frac{1}{3}$;

£80 : £100 :: £3 : rate per cent.; therefore rate per cent. = £$3\frac{3}{4}$;

therefore advantage = £3. 15s. − £3. 6s. 8d. = 8s. 4d.

8. £98 : £800 :: £3 : income on $\frac{2}{5}$ of £2000;

£100 : £1200 :: £$3\frac{1}{2}$: income on remainder of £2000;

$$\text{therefore 1st income} = £\,\frac{800 \times 3}{98} = \overset{£}{24} \,.\, \overset{s.}{9} \,.\, \overset{d.}{9\frac{27}{49}}$$

$$\text{2nd income} = £\,\frac{1200 \times 7}{100 \times 2} = 42 \,.\, 0 \,.\, 0$$

$$\text{therefore whole income} = \overline{66 \,.\, 9 \,.\, 9\frac{27}{49}}$$

9. £$4\frac{1}{2}$: £$3\frac{1}{2}$ :: £100 : price of stock;

$$\text{therefore price of stock} = £\,\frac{100 \times 7 \times 2}{9 \times 2} = £77\tfrac{7}{9},$$

and £$77\frac{7}{9}$: £1200 :: £100 : quantity of stock;

$$\text{therefore quantity of stock} = £\,\frac{1200 \times 100 \times 9}{700} = £1542.\ 17s.\ 1\tfrac{5}{7}d.$$

10. £99 : £90 :: £1100 : amount required;

$$\text{therefore amount} = £\,\frac{90 \times 1100}{99} = £1000.$$

11. £100 : £500 :: £$4\frac{1}{4}$: whole gain;

$$\text{therefore whole gain} = £\,\frac{500 \times 17}{100 \times 4} = £21.\ 5s.$$

12. £81 : £9450 :: £$13\frac{1}{2}$: loss required;

$$\text{therefore loss} = £\,\frac{9450 \times 27}{81 \times 2} = £1575.$$

13. £3 : £$3\frac{1}{2}$ :: £$89\frac{1}{2}$: price required;

$$\text{therefore price} = £\,\frac{7 \times 179}{3 \times 2 \times 2} = £104.\ 8s.\ 4d.$$

14. £$88\frac{3}{8}$: £$\frac{1000}{3}$ :: £$1\frac{1}{2}$: half-yearly income;

$$\text{therefore income} = £\,\frac{1000 \times 3 \times 8}{3 \times 2 \times 707} = £5.\ 13s.\ 1\tfrac{601}{707}d.$$

15. £100 : £1000 :: £4 : 1st income; therefore 1st income = £40;

£100 : £1000 :: £90 : value of 4 per cent. stock;

$$\text{therefore value of 4 per cent. stock} = £\,\frac{1000 \times 90}{100} = £900,$$

and £72 : £900 : £3 : income from 3 per cents.;

$$\text{therefore 2nd income} = £\,\frac{900 \times 3}{72} = £37.\ 10s.;$$

therefore difference in his income = £40 — £37. 10s. = £2. 10s.

16. £100 : £5000 :: £$3\frac{1}{2}$: income from £5000 stock;

$$\text{therefore 1st income} = £\frac{5000\times 7}{100\times 2} = £175.$$

£$102\frac{2}{3}$: £5000 :: £$3\frac{1}{2}$: income from investment;

$$\text{therefore 2nd income} = £\frac{5000\times 7\times 3}{2\times 308} = £170.\ 9s.\ 1\tfrac{1}{11}d.$$

17. £100 : £12600 :: £3 : income; therefore income = £378;

£100 : £12600 :: £95 : value of stock; therefore value = £11970.

18. £$98\frac{1}{4}$: £$89\frac{3}{8}$ :: £3000 : quantity of $3\frac{1}{2}$ per cent. stock;

$$\text{therefore quantity of stock} = £\frac{715\times 3000\times 4}{393\times 8} = £2729\tfrac{1}{131};$$

£100 : £$2729\frac{1}{131}$ :: $3\frac{1}{2}$: income from $3\frac{1}{2}$ per cents.;

$$\begin{array}{rcccc} & & £ & s. & d. \\ \text{therefore 2nd income} = £\dfrac{357500\times 7}{131\times 2\times 100} & = & 95 & 10 & 3\frac{87}{131} \\ \text{and 1st income} = £\dfrac{3000\times 3}{100} & = & 90 & 0 & 0 \\ \hline \text{therefore alteration in his income} & = & 5 & 10 & 3\frac{87}{131} \end{array}$$

19. In the 3 per cents. at $90\frac{1}{2}$, £1 gives £$\dfrac{3}{90\frac{1}{2}}$ interest, or £$\dfrac{6}{181}$.

In the 4 per cents. at 101, £1 gives £$\dfrac{4}{101}$ interest;

and, since $\dfrac{4}{101}$ is greater than $\dfrac{6}{181}$, the latter investment is the better.

20. £83 : £$1037\frac{1}{2}$ :: £100 : quantity of 3 per cent. stock;

$$\text{therefore quantity of 3 per cent. stock} = £\frac{2075\times 100}{83\times 2} = £1250;$$

£96 : £84 :: £1250 : quantity of 4 per cent. stock;

$$\text{therefore quantity of 4 per cent. stock} = £\frac{1250\times 84}{96} = £1093\tfrac{3}{4};$$

therefore £100 : £1250 :: £3 : 1st income, or 1st income = £37. 10*s.*,

£100 : £$1093\frac{3}{4}$ :: £4 : 2nd income, or 2nd income = £43. 15*s.*;

therefore difference of income = £43. 15*s.* − £37. 10*s.* = £6. 5*s.*

21. In 1st stock £1 gives $£\frac{3\frac{1}{2}}{96}$, or $£\frac{7}{192}$ interest.

In 2nd.................. $£\frac{4}{111}$ interest;

therefore, since 7×111 is greater than 4×192, the $3\frac{1}{2}$ per cents. is the better investment,

$$\text{and difference} = £\left(\frac{7}{192} - \frac{4}{111}\right) = £\frac{9}{192 \times 111};$$

$$\text{therefore difference per cent.} = £\frac{900}{192 \times 111} = 10\tfrac{5}{37}d.$$

22. £96 : £512 :: $£1\frac{1}{2}$: half-yearly income;

$$\text{therefore half-yearly income} = £\frac{512 \times 3}{96 \times 2} = £8,$$

$$\text{and income-tax} = (8 \times 7)d. = 4s.\ 8d.;$$

$$\text{therefore net income} = £8 - 4s.\ 8d. = £7.\ 15s.\ 4d.$$

23. $£103\frac{3}{8}$: £100 :: £1654 : present worth;

$$\text{therefore present worth} = £\frac{100 \times 1654 \times 8}{827} = £1600;$$

therefore £96 : £1600 :: £100 : quantity of stock required;

$$\text{therefore quantity of stock} = £\frac{1600 \times 100}{96} = £1666.\ 13s.\ 4d.$$

24. Interest on £1 in $3\frac{1}{2}$ per cents. $= £\frac{3\frac{1}{2}}{87} = £\frac{7}{174}$.

.... $3\frac{3}{4}$ shares $= £\frac{3\frac{3}{4}}{89} = £\frac{15}{356}$.

Hence, since 15×174 is greater than 7×356, the railway shares are the better investment.

25. £100 : £2950 :: £3 : income from 3 per cents.;

$$\text{therefore 1st income} = £\frac{2950 \times 3}{100} = £88.\ 10s.,$$

£108 : £81 :: £2950 : quantity of 5 per cent. stock;

therefore quantity of 5 per cent. stock $= £2212\frac{1}{2}$.

£100 : $£2212\frac{1}{2}$ :: £5 : 2nd income;

$$\text{therefore 2nd income} = £\frac{4425 \times 5}{2 \times 100} = £110.\ 12s.\ 6d.$$

Hence, difference $= £110.\ 12s.\ 6d. - £88.\ 10s. = £22.\ 2s.\ 6d.$

26. £1 in 3 per cents. gives £$\frac{3}{87\frac{3}{8}}$, or £$\frac{24}{699}$ interest,

£1 in $7\frac{2}{3}$ shares gives £$\frac{7\frac{2}{3}}{233}$, or £$\frac{23}{699}$ interest;

therefore the 3 per cents. are the better investment.

Also £3 : £460 :: £$87\frac{3}{8}$: sum to be invested; ∴ 1st sum = £13397. 10*s.*,

£$\frac{23}{699}$: £460 :: £1 : 2nd investment; ∴ 2nd sum = £13980.

27. $(3\frac{1}{2} \times 7)$*d.* = 2*s.* $0\frac{1}{2}$*d.* = income-tax on £100 stock;

therefore net income on £100 stock = £3. 10*s.* − 2*s.* $0\frac{1}{2}$*d.* = £3. 7*s.* $11\frac{1}{2}$*d.*;

therefore £3. 7*s.* $11\frac{1}{2}$*d.* : £460 :: £91 : sum required;

therefore sum required = £$\frac{441600 \times 91}{3262}$ = £12319. 6*s.* $3\frac{45}{233}$*d.*

28. In 13 years the dividend on £100 stock, at 3 per cent., was £(3 × 13) = £39;

∴ £39 : £3081 :: £100 : amount of stock; ∴ stock = £7900,

and £100 : £7900 :: £$79\frac{7}{8}$: value of stock; ∴ value = £6310. 2*s.* 6*d.*

29. £100 : £3200 :: £3 : 1st income; ∴ 1st income = £96,

£100 : £3200 :: £$99\frac{3}{4}$: value of stock; ∴ value = £3192,

£100 : £45 :: £5 : int. per share; ∴ int. per share = £$2\frac{1}{4}$,

£56 : £3192 :: £$2\frac{1}{4}$: 2nd income; ∴ 2nd income = £128. 5*s.*;

therefore difference of income = £128. 5*s.* — £96 = £32. 5*s.*

30. £$79\frac{5}{8}$: £1911 :: 100 : stock bought; therefore stock bought = £2400,

and stock must be sold for £1911 + £150 = £2061;

therefore £2400 : £100 :: £2061 : price of stock; therefore price = £$85\frac{7}{8}$;

therefore to pay the brokerage, the price must be £$(85\frac{7}{8} + \frac{1}{8})$, or £86.

31. Income from South Sea Annuities = £300,

£100 : £110 :: £10000 : amount of $2\frac{1}{2}$ stock;

therefore amount of $2\frac{1}{2}$ stock = £11000;

therefore income from $2\frac{1}{2}$ stock = £$(110 \times 2\frac{1}{2})$ = £275;

therefore loss of income from accepting this stock = £25.

Again, £93 : £10000 :: £3 : income from investment in consols;

therefore income from consols = £322. 11*s.* $7\frac{1}{31}$*d.*;

therefore gain by investing in consols = £22. 11*s.* $7\frac{1}{31}$*d.*

32. £100 : £4000000 :: £$\frac{1}{2}$: saving; therefore saving = £20000,

£100 : £4000000 :: £$5\frac{5}{8}$: loss of fundholders;

therefore loss = £$\frac{4000000 \times 45}{100 \times 8}$ = £225,000.

PROFIT AND LOSS.

Ex. LXIII. (p. 249.)

1. Gain per cwt. = £2. 0*s*. 8*d*. − £1. 12*s*. = 8*s*. 8*d*.;

∴ 1 cwt. : 5 cwt. 3 qrs. 14 lbs. :: 8*s*. 8*d*. : whole gain;

∴ whole gain = $\frac{47 \times 104}{8}$ *d*. = £2. 10*s*. 11*d*.

2. Gain on whole = £11. 18*s*. 11*d*. − £9. 8*s*. = £2. 10*s*. 11*d*.;

∴ 5 cwt. 3 qrs. 14 lbs. : 1 cwt. :: £2. 10*s*. 11*d*. : gain per cwt.;

∴ gain per cwt. = $\frac{8 \times 611}{47}$ *d*. = 8*s*. 8*d*.

3.

		£	*s*.	*d*.		£	*s*.	*d*.
43	articles at	4	6	8	each cost	186	6	8
57	....	11	8	6	....	651	4	6
4	....	13	15	4	....	55	1	4
∴ 104	....		cost		....	892	12	6

Again, 3 : 104 :: £28 : price the articles sold for;

∴ price of selling = £ $\frac{104 \times 28}{3}$ = £970. 13*s*. 4*d*.;

∴ gain = £970. 13*s*. 4*d*. − £892. 12*s*. 6*d*. = £78. 0*s*. 10*d*.

4. 300 yds. at 5*s*. 6*d*. bring £82. 10*s*.,

100 yds. at 2*s*. £10. 0*s*.;

∴ the silk sells for £92. 10*s*.

Hence gain = £92. 10*s*. − £80. = £12. 10*s*.;

∴ 80 : 100 :: £12. 10*s*. : gain per cent.;

∴ gain per cent. = £ $\frac{100 \times 25}{80 \times 2}$ = £15. 12*s*. 6*d*.

5.

cwt.		*d*.		£	*s*.
2	of sugar at	6	per lb. =	5	12
4	....	$4\frac{1}{2}$	.... =	8	8
3	....	$5\frac{1}{2}$	.... =	7	14;

∴ he must sell the remaining 3 cwt. for

£14 − £7. 14*s*., or, for £6. 6*s*.

Hence 3 cwt. : 1 lb. :: £6. 6*s*. : price per lb.;

∴ price per lb. = $\frac{126 \times 12}{3 \times 112}$ *d*. = $4\frac{1}{2}$*d*.

6. The commodity sells for 896*d.* per cwt.,

.... costs ... 821*d.* ....

$\therefore$ an outlay of 821*d.* gains 75*d.*

Hence 821*d.* : 75*d.* :: £100 : gain per cent.;

$$\therefore \text{gain per cent.} = £\frac{75 \times 100}{821} = £9.\ 2s.\ 8\tfrac{368}{821}d.$$

7. The goods cost $(6\frac{1}{2} \times 112)d.$ or 728*d.* per cwt.,

.... sold for .... 1080*d.* ....

$\therefore$ an outlay of 728*d.* gained 352*d.*

Hence 728*d.* : 352*d.* :: £100 : gain per cent.;

$$\therefore \text{gain per cent.} = £\frac{100 \times 352}{728} = £\frac{100 \times 44}{91} = £48.\ 7s.\ 0\tfrac{1}{4}d.\ \tfrac{53}{91}q.$$

8. An outlay of 3*s.* 6*d.* gained $4\frac{1}{2}d.$;

$\therefore$ 3*s.* 6*d.* : $4\frac{1}{2}d.$ :: £100 : gain per cent.;

$$\therefore \text{gain per cent.} = £\frac{9 \times 100}{2 \times 42} = £10.\ 14s.\ 3\tfrac{1}{4}d.\ \tfrac{5}{7}q.$$

9. $£122\frac{38}{41}$: £100 :: $£12\frac{3}{5}$: cost price;

$$\therefore \text{cost price} = £\frac{100 \times 63 \times 41}{5 \times 5040} = £10.\ 5s.$$

10. Cost price = 22*s.* − 5*s.* 6*d.* = 16*s.* 6*d.*;

$\therefore$ 16*s.* 6*d.* : 5*s.* 6*d.* :: £100 : gain per cent.;

$$\therefore \text{gain per cent.} = £\frac{11 \times 100}{33} = £33.\ 6s.$$

11. £82 : £100 :: $£24\frac{3}{5}$: cost price;

$$\therefore \text{cost price} = £\frac{100 \times 123}{82 \times 5} = £30.$$

12. £95 : £100 :: 5*s.* : cost price;

$$\therefore \text{cost price} = \frac{100 \times 5}{95}s. = 5s.\ 3\tfrac{3}{19}d.$$

Again, 100 : $104\frac{1}{2}$ :: 5*s.* $3\frac{3}{19}d.$: required price;

$$\therefore \text{price required} = \frac{209 \times 1200}{100 \times 2 \times 19}d. = 66d. = 5s.\ 6d.$$

13. $$\text{Expense of sale} = \frac{1}{20} \text{ of } 6s.\ 8d. = 4d.;$$

$$\therefore \text{ whole outlay} = 6s.\ 8d. + 4d. = 7s.,$$

$$\text{and } £100 : £125 :: 7s. : \text{selling price};$$

$$\therefore \text{ selling price} = \frac{125 \times 7}{100} s. = 8s.\ 9d.$$

14. $$£92 : £100 :: £25\tfrac{1}{2} : \text{cost price};$$

$$\therefore \text{ cost price} = £\frac{100 \times 51}{92 \times 2} = £27\tfrac{33}{46}.$$

Hence $$\text{gain if sold for } £38 = £10\tfrac{13}{46};$$

$$\therefore £27\tfrac{33}{46} : £10\tfrac{13}{46} :: £100 : \text{gain per cent.},$$

$$\text{or, gain per cent.} = £\frac{473 \times 100 \times 46}{46 \times 1275} = £\frac{1892}{51} = £37.\ 1s.\ 11\tfrac{1}{2}d.\ \tfrac{2}{17}q.$$

15. $$\text{Cost per head} = £2.\ 2s. + 5s.\ 6d. = £2.\ 7s.\ 6d.;$$

$$\therefore \text{ gain per head} = £2.\ 8s.\ 6d. - £2.\ 7s.\ 6d. = 1s.;$$

$$\therefore \text{ whole gain} = 500s. = £25.$$

Also $$£2\tfrac{3}{8} : £\frac{1}{20} :: £100 : \text{rate per cent.};$$

$$\therefore \text{ rate per cent.} = £\frac{100 \times 8}{20 \times 19} = £2.\ 2s.\ 1\tfrac{1}{4}d.\ \tfrac{1}{19}q.$$

16. $$£100 : £120 :: £40 : \text{selling price with 20 per cent. profit};$$

$$\therefore \text{ selling price} = £\frac{120 \times 40}{100} = £48.$$

Also $$£100 : £105 :: £20 : \text{selling price of } £20 \text{ with 5 per cent. profit};$$

$$\therefore \text{ he sells half for } £\frac{105 \times 20}{100} \text{ or } £21.$$

Hence remainder must be sold for £48 − £21 or £27.

17. $$\text{The wine cost } (36 \times 10)s. = £18;$$

$$\therefore £100 : £120 :: £18 : \text{selling price};$$

$$\therefore \text{ selling price} = £\frac{120 \times 18}{100} = £21.\ 12s.$$

$$\text{Hence price per gallon} = \frac{£21.\ 12s.}{30} = 14s.\ 4\tfrac{4}{5}d.$$

18. Gain to be made on 50 bullocks

$$=\pounds 120+\pounds 12.\ 10s.+\pounds 62.\ 10s.=\pounds 195;$$

$$\therefore \text{ gain on each}=\pounds\,\frac{195}{50}=\pounds 3.\ 18s.$$

19. 2 lbs. of the mixture cost 3*s.* 8*d.* + 4*s.* 4*d.* or 8*s.*;

$\therefore$ 1 lb. will cost 4*s.*;

$\therefore$ £100 : £115 :: 4*s.* : selling price,

$$\text{or selling price}=\frac{115\times 4}{100}s.=4s.\ 7\tfrac{1}{5}d.$$

20. £100 : £120 :: £30 : selling price;

$$\therefore \text{ selling price}=\pounds\,\frac{120\times 30}{100}=\pounds 36.$$

Again, £100 : £90 :: £10 : price $\frac{1}{3}$ of the goods sold for;

$$\therefore \text{ price fetched by } \tfrac{1}{3} \text{ of the goods}=\pounds\,\frac{90\times 10}{100}=\pounds 9;$$

$\therefore$ he must sell the remainder for £36—£9 or £27.

21. £100 : £130 :: £525 : price the house sold for;

$$\therefore \text{ price of house}=\pounds\,\frac{525\times 130}{100}=\pounds 682.\ 10s.,$$

$$\text{and expenses of sale}=\frac{1}{20}\text{ of }\pounds 682.\ 10s.=\pounds 34.\ 2s.\ 6d.;$$

$\therefore$ sum to be received = £682. 10*s.*—£34. 2*s.* 6*d.* = £648. 7*s.* 6*d.*

22. Number of gallons sold = 76—13 + 9 = 72;

$\therefore$ selling price = 7*s.* 6*d.* × 72 = £27;

$\therefore$ gain = £27—£23. 12*s.* 6*d.* = £3. 7*s.* 6*d.*

Hence £$23\frac{5}{8}$: £$3\frac{3}{8}$ :: £100 : gain per cent.;

$$\therefore \text{ gain per cent.}=\pounds\,\frac{100\times 27\times 8}{8\times 189}=\pounds\,\frac{100}{7}=\pounds 14.\ 5s.\ 8\tfrac{1}{2}d.\ \tfrac{2}{7}q.$$

23. Profit on 1000 quills = $\frac{3}{8}$ of 11*s.* + 2*s.* 6*d.*

$= 4s.\ 1\frac{1}{2}d. + 2s.\ 6d. = 6s.\ 7\frac{1}{2}d.$;

$\therefore$ cost of 1000 quills = 13*s.* 6*d.*—6*s.* $7\frac{1}{2}d.$ = 6*s.* $10\frac{1}{2}d.$

Hence 6*s.* $10\frac{1}{2}d.$: 6*s.* $7\frac{1}{2}d.$ :: £100 : gain per cent.;

$$\therefore \text{ gain per cent.}=\pounds\,\frac{318\times 100}{330}=\pounds 96.\ 7s.\ 3\tfrac{3}{11}d.$$

24. £8. 14*s.* = cost price of (72 + 11·52) yds. or 83·52 yds.;

$$\therefore \text{ cost of each yard} = \frac{174}{83{\cdot}52}\,s.;$$

$$\therefore \text{ whole profit} = \frac{11{\cdot}52 \times 174}{83{\cdot}52}\,s. = £1.\ 4s.;$$

$$\therefore \text{ cost price} = £8.\ 14s. - £1.\ 4s. = £7.\ 10s.$$

Hence £7. 10*s.* : £1. 4*s.* :: £100 : gain per cent.;

$$\therefore \text{ gain per cent.} = £\frac{100 \times 24}{150} = £16.$$

25. Cost of tobacco = $(15 \times 6 \times 112)d.$ = £42.

Hence, (1) 4 cwt. : 1 lb. :: £42 : price in first case;

$$\therefore \text{ price for neither gain or loss} = £\frac{42}{448} = 1s.\ 10\tfrac{1}{2}d.$$

(2) 4 cwt. : 1 lb. :: £$47\frac{1}{4}$: price in second case;

$$\therefore \text{ price to gain 5 guineas} = £\frac{189}{448 \times 4} = 2s.\ 1\tfrac{1}{4}d.\ \tfrac{1}{4}q.$$

(3) 4 cwt. : 1 lb. :: £84 : price in third case;

$$\therefore \text{ price to gain cent. per cent.} = £\frac{84}{448} = 3s.\ 9d.$$

26. £$84\frac{1}{2}$: £$15\frac{1}{2}$ :: £3000 : gain;

$$\therefore \text{ gain} = £\frac{3000 \times 31 \times 2}{169 \times 2} = £550.\ 5s.\ 11\tfrac{1}{169}d.,$$

$$\text{and gain per cent.} = \frac{1}{30} \text{ of the whole gain} = £18.\ 6s.\ 10\tfrac{62}{169}d.$$

27. $$\text{Selling price per pipe} = \frac{1}{14\frac{1}{2}} \text{ of } £1120\tfrac{14}{25} = £\frac{1932}{25};$$

$$\therefore £80 : £100 :: £\frac{1932}{25} : \text{cost price per pipe};$$

$$\therefore \text{ cost price per pipe} = £\frac{100 \times 1932}{25 \times 80} = £96.\ 12s.$$

$$\text{Also selling price per gallon} = \frac{1}{126} \text{ of } £\frac{1932}{25} = 12s.\ 3\tfrac{1}{5}d.$$

28. Rent on 1st supposition = £96 + (no. of qrs. × 56) *s.*,

.... 2nd .... = £96 + (no. of qrs. × 38) *s.*,

Hence £100 : £85 :: £96 + (no. of qrs. × 56) *s.* : £96 + (no. of qrs. × 38) *s.*;

$$\therefore £96+(\text{no. of qrs.}\times 38)s.=\frac{\{£96+(\text{no. of qrs.}\times 56)s.\}\times 85}{100};$$

$$\therefore £96+(\text{no. of qrs.}\times 38)s.=\frac{17}{20}\text{ of }£96+\frac{17}{20}\text{ of }(\text{no. of qrs.}\times 56)s.;$$

$$\therefore \frac{3}{20}\text{ of }£96=\left(\frac{17}{20}\times 56-38\right)s.\times\text{no. of qrs.};$$

$$\therefore £288=(952-760)s.\times\text{no. of qrs.},$$

$$\text{or }(288\times 20)s.=192s.\times\text{no. of qrs.};$$

$$\therefore \text{no. of qrs.}=\frac{288\times 20}{192}=30.$$

29. £100 : £104 :: £150 : price to gain 4 per cent.;

$$\therefore \text{selling price}=£\frac{104\times 150}{100}=£156.$$

And £100 : £96 :: £50 : price $\frac{1}{3}$ of goods were sold at;

$$\therefore \text{price of }\tfrac{1}{3}\text{ of goods}=£\frac{96\times 50}{100}=£48.$$

He must now sell the rest for £108, and the excess of this sum over £96 (at which price he would have sold the goods at the first rate) being £12, we have

£96 : £12 :: 100 : rate of increase per cent.;

$$\therefore \text{rate per cent.}=\frac{100\times 12}{96}=12\tfrac{1}{2}.$$

30. By the sale the person receives $\frac{95}{100}$ of cost of watch.

If he had received £3 more he would have had $\frac{101}{100}$ of cost of watch;

$$\therefore \frac{101}{100}\text{ cost of watch}=\frac{95}{100}\text{ cost of watch}+£3,$$

$$\text{or }\frac{6}{100}\text{ cost of watch}=£3;\ \therefore\text{ watch costs }£50.$$

Again, since the duty was 25 per cent.,

125 : 100 :: £50 : price received by French maker;

$$\therefore \text{maker receives }£\frac{100\times 50}{125}\text{ or }£40.$$

Ex. LXIV. (p. 255.)

1. $$1500+7000+9500=18000;$$

$\therefore$ 18000 : 1500 :: 72 : number from 1st town,

18000 : 7000 :: 72 : number from 2nd town,

18000 : 9500 :: 72 : number from 3rd town;

$$\therefore \text{number from 1st town} = \frac{1500 \times 72}{18000} = 6,$$

$$\text{number from 2nd town} = \frac{7000 \times 72}{18000} = 28,$$

$$\text{number from 3rd town} = \frac{9500 \times 72}{18000} = 38.$$

2. $$16+5=21;$$

$\therefore$ 21 : 16 :: £17. 11*s.* 9*d.* : larger part;

$$\therefore \text{larger part} = \frac{16 \times 4221}{21}\,d. = £13.\ 8s.$$

And 21 : 5 :: £17. 11*s.* 9*d.* : smaller part;

$$\therefore \text{smaller part} = \frac{5 \times 4221}{21}\,d. = £4.\ 3s.\ 9d.$$

3. $$3+5+7+11=26;$$

$\therefore$ 26 : 3 :: 4472 : 1st part; $\therefore$ 1st part = 516,

26 : 5 :: 4472 : 2nd part; $\therefore$ 2nd part = 860,

26 : 7 :: 4472 : 3rd part; $\therefore$ 3rd part = 1204,

26 : 11 :: 4472 : 4th part; $\therefore$ 4th part = 1892.

Again, $$\frac{1}{2}+\frac{3}{5}+\frac{5}{7}=\frac{117}{70};$$

$\therefore \frac{117}{70} : \frac{1}{2}$ :: £500 : 1st part; $\therefore$ 1st part = £149. 11*s.* $5\frac{17}{39}$*d.*,

$\frac{117}{70} : \frac{3}{5}$ :: £500 : 2nd part; $\therefore$ 2nd part = £179. 9*s.* $8\frac{12}{13}$*d.*,

$\frac{117}{70} : \frac{4}{7}$ :: £500 : 3rd part; $\therefore$ 3rd part = £170. 18*s.* $9\frac{25}{39}$*d.*

4. Sum of the debts = £601. 10*s.*;

£	£	£		£	s.	d.
$\therefore 601\frac{1}{2}$:	$256\frac{1}{3}$ ::	$421\frac{1}{20}$:	*A*'s dividend; $\therefore$ *A* has	179 .	8 .	8
$601\frac{1}{2}$:	$203\frac{1}{2}$ ::	$421\frac{1}{20}$:	*B*'s dividend; $\therefore$ *B* has	142 .	9 .	0
$601\frac{1}{2}$:	$141\frac{2}{3}$ ::	$421\frac{1}{20}$:	*C*'s dividend; $\therefore$ *C* has	99 .	3 .	4

5. Sum of parts $= 3 + 4 + 15 = 22$;

$\therefore 22 : 15 :: \overset{\text{cwt.}}{18} :$ weight of gold; $\therefore$ weight of gold $= \overset{\text{cwt.}}{12} \;.\; \overset{\text{lbs.}}{30\tfrac{6}{11}}$,

$22 : 4 :: 18 :$ weight of silver; $\therefore$ weight of silver $= 3 \;.\; 30\tfrac{6}{11}$,

$22 : 3 :: 18 :$ weight of copper; $\therefore$ weight of copper $= 2 \;.\; 50\tfrac{10}{11}$.

6. Amount of capital $= £2200 + £1800 = £4000$;

$\therefore \overset{£}{4000} : \overset{£}{2200} :: \overset{£}{720} :$ larger share; $\therefore$ larger share $= \overset{£}{396}$,

$4000 : 1800 :: 720 :$ smaller share; $\therefore$ smaller share $= 324$.

7. Sum of the parts $= 100$;

$\therefore 100 : 49{\cdot}856 :: \overset{\text{lbs.}}{112} :$ wt. of oxygen; $\therefore$ wt. of oxygen $= \overset{\text{lbs.}}{1116{\cdot}7744}$,

$100 : 43{\cdot}265 :: 112 :$ wt. of carbon; $\therefore$ wt. of carbon $= 969{\cdot}136$,

$100 : 6{\cdot}879 :: 112 :$ wt. of hydrogen; $\therefore$ wt. of hydrogen $= 154{\cdot}0896$.

8. Number of shares $= 3 + 6 + 3 = 12$;

$\therefore 12 : 3 :: \overset{£}{13000} :$ eldest son's share; $\therefore$ eldest son's share $= \overset{£}{3250} \;.\; \overset{s.}{0} \;.\; \overset{d.}{0}$

$12 : 2 :: 13000 :$ a younger son's share;

$\therefore$ a younger son's share $= 2166 \;.\; 13 \;.\; 4$

$12 : 1 :: 13000 :$ a daughter's share;

$\therefore$ a daughter's share $= 1083 \;.\; 6 \;.\; 8$

9. Capital $= 3200$. Sum to be divided $= £800 - £80 = £720$;

$\therefore \overset{£}{3200} : \overset{£}{2000} :: \overset{£}{720} :$ B's share; $\therefore$ B's share $= \overset{£}{450}$

$3200 : 1200 :: 720 :$ A's share; $\therefore$ A's share $= 270$;

$\therefore$ A receives in all $£270 + £80 = £350$.

10. If A and B have each 1 share; C will have 2 such shares, and D 4 such shares;

$\therefore 8 : 1 :: \overset{£}{100} :$ A's or B's share; $\therefore$ A and B have $\overset{£}{12} \;.\; \overset{s.}{10}$

$8 : 2 :: 100 :$ C's share; $\therefore$ C has $25 \;.\; 0$

$8 : 4 :: 100 :$ D's share; $\therefore$ D has $50 \;.\; 0$

11. A's share $= \frac{4}{3}$ B's share, and C's share $= \frac{5}{6}$ B's share;

$\therefore$ A's share $+$ B's share $+$ C's share $= \left(\frac{4}{3} + 1 + \frac{5}{6}\right)$ B's share;

$$\therefore £11875 = \frac{19}{6}\ B\text{'s share};$$

$$\therefore B\text{'s share} = \frac{6}{19} \text{ of } \overset{\pounds}{11875} = \overset{\pounds}{3750},$$

$$A\text{'s share} = \tfrac{4}{3} \text{ of } 3750 = 5000,$$

$$C\text{'s share} = \tfrac{5}{6} \text{ of } 3750 = 3125.$$

12. $$\pounds(1000 \times 5 + 15000 \times 3) : \pounds(15000 \times 3) :: \pounds 1500 : B\text{'s share};$$

$$\therefore B\text{'s share} = \pounds\frac{15000 \times 3 \times 1500}{50000} = \pounds 1350.$$

13. $$\text{Equated time} = \frac{700 \times 3 + 800 \times 5 + 500 \times 10}{700 + 800 + 500} \text{ mo.} = 5\tfrac{11}{20} \text{ mo.}$$

14. $$\text{Equated time} = \frac{375 \times 4 + 281\frac{1}{4} \times 5 + 93\frac{3}{4} \times 6}{750} \text{ mo.}$$

$$= \frac{13875}{4 \times 750} \text{ mo.} = \frac{37}{8} \text{ mo.} = 4\tfrac{5}{8} \text{ mo.}$$

15. $$\text{Remainder of debt} = \frac{13}{60};$$

$$\therefore \frac{13}{60} \times \text{no. of months required} = 7\tfrac{1}{30} - \frac{1}{3} \times 4 - \frac{1}{4} \times 6 - \frac{1}{5} \times 8 = \frac{13}{5};$$

$$\therefore \text{no. of months required} = \frac{13}{5} \times \frac{60}{13} = 12.$$

16. $$70 \times 6 + 40 \times 9 + 50 \times 7 : 50 \times 7 :: \pounds 11\tfrac{3}{10} : C\text{'s share};$$

$$\therefore C\text{'s share} = \pounds\frac{350 \times 113}{1130 \times 10} = \pounds 3.\ 10s.$$

17. $$\text{Profits to be shared by } B \text{ and } C = \tfrac{3}{4} \text{ of } \pounds 450 = \pounds 337\tfrac{1}{2};$$

$$\therefore \pounds 500 + \pounds 300 : \pounds 300 :: \pounds 337\tfrac{1}{2} : C\text{'s share};$$

$$\therefore C\text{'s share} = \pounds\frac{300 \times 675}{2 \times 800} = \pounds 126.\ 11s.\ 3d.$$

18. $$(25 \times 4 + 25 \times 12) + (15 \times 6 + 30 \times 12) + (70 \times 6) = 1270;$$

$$\therefore 1270 : 400 :: \overset{\pounds}{254} : A\text{'s share}; \quad \therefore A\text{'s share} = \overset{\pounds}{80},$$

$$1270 : 450 :: 254 : B\text{'s share}; \quad \therefore B\text{'s share} = 90,$$

$$1270 : 420 :: 254 : C\text{'s share}; \quad \therefore C\text{'s share} = 84.$$

Ex. LXV. (p. 259.)

1. $100 : \frac{1}{3} :: 56394$: per centage required;

$$\therefore \text{ per centage required} = \frac{56394 \times \frac{1}{3}}{100} = \frac{18798}{100} = 187{\cdot}98.$$

$100 : \frac{5}{8} :: 56394$: per centage required;

$$\therefore \text{ per centage required} = \frac{56394 \times \frac{5}{8}}{100} = \frac{28197}{80} = 352{\cdot}4625.$$

$100 : 4 :: 56394$: per centage required;

$$\therefore \text{ per centage required} = \frac{56394 \times 4}{100} = 2255{\cdot}76.$$

$100 : 7\frac{3}{5} :: 56394$: per centage required;

$$\therefore \text{ per centage required} = \frac{56394 \times 38}{100 \times 5} = \frac{2142972}{500} = \frac{4285944}{1000} = 4285{\cdot}944.$$

$100 : 10 :: 56394$: per centage required;

$$\therefore \text{ per centage required} = \frac{56394 \times 10}{100} = 5639{\cdot}4.$$

$100 : 150\frac{1}{2} :: 56394$: per centage required;

$$\therefore \text{ per centage required} = \frac{56394 \times 301}{100 \times 2} = \frac{8487297}{100} = 84872{\cdot}97.$$

2. $96 : 100 :: 15$: number required;

$$\therefore \text{ number required} = \frac{100 \times 15}{96} = \frac{125}{8} = 15{\cdot}625.$$

$81 : 100 :: 19$: number required;

$$\therefore \text{ number required} = \frac{100 \times 19}{81} = \frac{1900}{81} = 23\tfrac{37}{81} = 23{\cdot}456\ldots$$

$256 : 100 :: 23$: number required;

$$\therefore \text{ number required} = \frac{100 \times 23}{256} = \frac{575}{64} = 8\tfrac{63}{64} = 8{\cdot}984375.$$

$7321{\cdot}75 : 100 :: 185\frac{1}{4}$: number required;

$$\therefore \text{ number required} = \frac{100 \times 741}{7321{\cdot}75 \times 4} = \frac{74100}{29287} = 2{\cdot}530\ldots$$

$11080{\cdot}5 : 100 :: 5{\cdot}\dot{3}$: number required;

$$\therefore \text{ number required} = \frac{100 \times 5\frac{1}{3}}{11080\frac{1}{2}} = \frac{100 \times 16 \times 2}{22161 \times 3} = \frac{3200}{66483} = {\cdot}048.$$

3. $$\tfrac{1}{2}\text{ per cent.}=\tfrac{1}{2}\div 100=\frac{1}{200}=\cdot 005.$$

$$2\tfrac{3}{4}\text{ per cent.}=2\tfrac{3}{4}\div 100=\frac{11}{400}=\cdot 0275.$$

$$4\tfrac{1}{3}\text{ per cent.}=4\tfrac{1}{3}\div 100=\frac{13}{300}=\cdot 04\dot{3}.$$

$$5\tfrac{5}{8}\text{ per cent.}=5\tfrac{5}{8}\div 100=\frac{45}{800}=\cdot 05625.$$

$$26\tfrac{1}{3}\text{ per cent.}=26\tfrac{1}{3}\div 100=\frac{79}{300}=\cdot 26\dot{3}.$$

$$230\cdot 05\text{ per cent.}=230\cdot 05\div 100=2\cdot 3005.$$

$$500\cdot 013\dot{8}\text{ per cent.}=500\cdot 013\dot{8}\div 100=5\cdot 00013\dot{8}.$$

4. If 27 per cent. leaked away, 73 per cent. remained in the cask;

$\therefore$ 100 : 2005 :: 73 : number of gallons remaining;

$$\therefore\text{ number of gallons remaining}=\frac{2005\times 73}{100}=\frac{146365}{100}=1463\cdot 65.$$

5. 100 : 7500 :: $112\frac{1}{2}$: bushels required;

$$\therefore\text{ number of bushels required}=\frac{7500\times 225}{100\times 2}=\frac{16875}{2}=8437\cdot 5.$$

6. By selling 15·75 oz. he gains ·25 oz.;

$\therefore$ 15·75 : ·25 :: 100 : gain per cent.;

$$\therefore\text{ gain per cent.}=\frac{100\times\cdot 25}{15\cdot 75}=\frac{2500}{1575}=\frac{100}{63}=1\frac{37}{63}.$$

7. 14804 : 100 :: 1588 : rate per cent. of mortality in Small-pox;

$$\therefore\text{ rate required}=\frac{100\times 1588}{14804}=\frac{39700}{3701}=10\cdot 72\ldots$$

2422 : 100 :: 211 : rate per cent. of mortality in Scarlet Fever;

$$\therefore\text{ rate required}=\frac{100\times 211}{2422}=\frac{10550}{1211}=8\cdot 71\ldots$$

17226 : 100 :: 1799 : rate per cent. of mortality in both sicknesses;

$$\therefore\text{ rate required}=\frac{100\times 1799}{17226}=\frac{89950}{8613}=10\cdot 44\ldots$$

8. Since $8175124-7767401=407723$,
and $8175124-6515794=1659330$,
and $7767401-6515794=1251607$,

7767401 : 407723 :: 100 : increase per cent. in the first ten years;

$$\therefore \text{ increase per cent.} = \frac{407723 \times 100}{7767401} = 5{\cdot}24\ldots$$

8175124 : 1659330 :: 100 : decrease per cent. in the last ten years;

$$\therefore \text{ decrease per cent.} = \frac{1659330 \times 100}{8175124} = 20{\cdot}29\ldots$$

7767401 : 1251607 :: 100 : decrease per cent. in the twenty years.

$$\therefore \text{ decrease per cent.} = \frac{1251607 \times 100}{7767401} = 16{\cdot}11\ldots$$

9. Population at end of first year $= \dfrac{1000000 \times 101\frac{1}{2}}{100} = 1015000,$

.... second year $= \dfrac{1015000 \times 101\frac{1}{2}}{100} = 1030225,$

.... third year $= \dfrac{1030225 \times 101\frac{1}{2}}{100} = 1045678{\cdot}375.$

10. Of the age of 18 there are 3 scholars.

Between 15 and 18 there are $\dfrac{5 \times 380}{100} = 19,$

.... 12 and 15 .... $\dfrac{10 \times 380}{100} = 38,$

.... 10 and 12 .... $\dfrac{35 \times 380}{100} = 133,$

and under 10 there will be $383 - (3 + 19 + 38 + 133) = 383 - 193 = 190.$

11. Since 1 ton $= (20 \times 112)$ lbs. $= 2240$ lbs.,

100 : 49·856 :: 2240 : number of pounds of oxygen;

$$\therefore \text{ number of lbs. oxygen} = \frac{49{\cdot}856 \times 2240}{100} = 1116{\cdot}7744.$$

100 : 43·265 :: 2240 : number of pounds of carbon;

$$\therefore \text{ number of lbs. carbon} = \frac{43{\cdot}265 \times 2240}{100} = 969{\cdot}136,$$

and number of lbs. hydrogen $= 2240 - (1116{\cdot}7744 + 969{\cdot}136) = 154{\cdot}0896.$

12. *M* obtained $724 + 23 + 8 + 15$, or, 770 votes,
S .... $724 + 1 + 5 + 5$, or, 735 votes,
A .... $685 + 23 + 20 + 1$, or, 729 votes,
H .... $685 + 8 + 5 + 4$, or, 702 votes.

Therefore number of votes on the register

$$=724+685+23+8+15+1+5+5+20+4+222=1712.$$

$$\text{Then}\qquad M\text{'s per centage}=\frac{770\times100}{1712}=44\frac{209}{214},$$

$$S\text{'s per centage}=\frac{735\times100}{1712}=42\frac{399}{428},$$

$$A\text{'s per centage}=\frac{729\times100}{1712}=42\frac{498}{856},$$

$$H\text{'s per centage}=\frac{702\times100}{1712}=41\frac{1}{214}.$$

13. Cost of wheat $=(340\times40\times8)s.=£5440$,

$$\text{number of bushels wasted }=\frac{340\times40\times2\frac{1}{2}}{100}=340;$$

$$\text{number of bushels left to sell}=(340\times40)-340=13260;$$

$$\text{of which he sells part for }\frac{56\times13260\times7\frac{1}{2}}{100}s.=£2784.\ 12s.$$

$$\text{.......................... part for }\frac{20\times13260\times8}{100}s.=£1060.\ 16s.$$

$$\text{.................... the rest for }\frac{24\times13260\times10}{100}s.=£1591.\ 4s.$$

$$\therefore\text{ he sells his wheat for }£5436.\ 12s.$$

$$\therefore\text{ he loses }£5440-£5436.\ 12s.=£3.\ 8s.$$

14. If M and F represent the number of males and females respectively,

$$\frac{101\cdot8\times(M+F)}{100}=\text{increased number of males and females,}$$

$$\frac{95\cdot4\times M}{100}=\text{decreased number of males,}$$

$$\frac{109\cdot8\times F}{100}=\text{increased number of females.}$$

$$\text{Then}\qquad\frac{95\cdot4\times M}{100}+\frac{109\cdot8\times F}{100}=\frac{101\cdot8\times(M+F)}{100};$$

$$\therefore\ 95\cdot4\times M+109\cdot8\times F=101\cdot8\times M+101\cdot8\times F;$$

$$\therefore\ (109\cdot8-101\cdot8)\times F=(101\cdot8-95\cdot4)\times M;$$

$$\therefore\ 8F=6\cdot4\times M,\text{ or, }80F=64M,\text{ or, }5F=4M,$$

$$\text{and}\ \therefore\ M:F::5:4.$$

Ex. LXVI. (p. 263.)

1.
$$\begin{array}{rrrrr} & \pounds & s. & d. \\ & 18697 \;.& 11 \;.& 9 \\ & 17292 \;.& 2 \;.& 10 \\ & 20135 \;.& 12 \;.& 10 \\ & 20078 \;.& 19 \;.& 7 \\ & 18582 \;.& 12 \;.& 11 \\ & 24048 \;.& 5 \;.& 1 \\ & 21631 \;.& 0 \;.& 1 \\ \hline 7 \,| & 140466 \;.& 5 \;.& 1 \\ \hline & \pounds 20066 \;.& 12 \;.& 1\frac{6}{7} \end{array}$$

2.
$$\begin{array}{rl} & 2679438 \\ & 2958272 \\ & 3030293 \\ & 3474302 \\ & 2243151 \\ & 2327782 \\ & 2855525 \\ & 2538234 \\ & 3206482 \\ & 2801204 \\ & 3251901 \\ \hline 11 \,| & 31366584 \\ \hline & 2851507\frac{7}{11} \text{ quarters.} \end{array}$$

3.
$$\begin{array}{rcrcr} s. \;\; d. & & & & s. \;\;\; d. \\ 77 \;.\; 8 & \times & 50 & = & 3883 \;.\; 4 \\ 78 \;.\; 3 & \times & 100 & = & 7825 \;.\; 0 \\ \hline \end{array}$$

∴ 150 quarters cost 11708 . 4

∴ 1 bushel cost $\frac{11708s.\ 4d.}{150 \times 8} = 9s.\ 9\frac{1}{12}d.$

4. United ages of 8 boys $= 32 + 22 + 24 = 78$;

∴ average age of boys $= \frac{78}{8} = 9\frac{3}{4}$.

United ages of 15 girls $= 48\frac{3}{4} + 36 + 20 + 52 = 156\frac{3}{4}$;

∴ average age of girls $= \frac{156\frac{3}{4}}{15} = \frac{627}{60} = 10\frac{9}{20}$.

United ages of 23 boys and girls $= 78 + 156\frac{3}{4} = 234\frac{3}{4}$;

∴ average age of the whole class $= \frac{234\frac{3}{4}}{23} = 10\frac{19}{92}$.

5. Average number of days $= \frac{84\frac{1}{2}}{19} = \frac{169}{38} = 4{\cdot}447\ldots$

6. $4{\cdot}5 + 4 + 3{\cdot}9 + 4{\cdot}1 + 3{\cdot}6 + 4{\cdot}2 + 3{\cdot}3 = 27{\cdot}6$;

∴ average number of days $= \frac{27{\cdot}6}{7} = 3{\cdot}9\dot{4}2857\dot{1}$.

7. $\frac{\pounds 377.\ 10s.}{3} = \pounds 125.\ 16s.\ 8d.$, the amount to be paid in money;

$\frac{\pounds 377.\ 10s.}{4} = \pounds 94.\ 7s.\ 6d.$, the amount to be paid in wheat;

£377. 10*s.*—£220. 4*s.* 2*d.* = £157. 5*s.* 10*d.* to be paid in barley.

$\therefore$ he gains in all £$\frac{460\times 9}{16\times 23}$, or £11. 5*s*.

10. Remitting to Cadiz directly, 1 pistole = £$\frac{3}{4}$.

Again, remitting through France,

$$1 \text{ pistole} = 19 \text{ francs} = £\frac{19}{25\cdot 4} = £\frac{190}{254},$$

and comparing the fractions $\frac{3}{4}$ and $\frac{190}{254}$ the former is found to be the greater; therefore it is better to transmit through France.

Ex. LXVI. (p. 263.)

(1) (1)

$$\begin{array}{r|l} & \dot{2}8\dot{9}\,(17 \\ & 1 \\ \cline{2-2} 27 & 189 \\ & 189 \\ \cline{2-2} \end{array} \qquad \begin{array}{r|l} & \dot{5}7\dot{6}\,(24 \\ & 4 \\ \cline{2-2} 44 & 176 \\ & 176 \\ \cline{2-2} \end{array} \qquad \begin{array}{r|l} & 1\dot{4}4\dot{4}\,(38 \\ & 9 \\ \cline{2-2} 68 & 544 \\ & 544 \\ \cline{2-2} \end{array} \qquad \begin{array}{r|l} & 4\dot{0}9\dot{6}\,(64 \\ & 36 \\ \cline{2-2} 124 & 496 \\ & 496 \\ \cline{2-2} \end{array}$$

(2)

$$\begin{array}{r|r} & 6\dot{5}6\dot{1}\,(81 \\ & 64 \\ \cline{2-2} 161 & 161 \\ & 161 \\ \cline{2-2} \end{array} \qquad \begin{array}{r|r} & \dot{2}1\dot{0}2\dot{5}\,(145 \\ & 1 \\ \cline{2-2} 24 & 110 \\ & 96 \\ \cline{2-2} 285 & 1425 \\ & 1425 \\ \cline{2-2} \end{array} \qquad \begin{array}{r|r} & 1\dot{7}3\dot{0}5\dot{6}\,(416 \\ & 16 \\ \cline{2-2} 81 & 130 \\ & 81 \\ \cline{2-2} 826 & 4956 \\ & 4956 \\ \cline{2-2} \end{array}$$

(3)

$$\begin{array}{r|r} & \dot{9}8\dot{5}9\dot{6}\,(314 \\ & 9 \\ \cline{2-2} 61 & 85 \\ & 61 \\ \cline{2-2} 624 & 2496 \\ & 2496 \\ \cline{2-2} \end{array} \qquad \begin{array}{r|r} & \dot{3}7\dot{2}4\dot{9}\,(193 \\ & 1 \\ \cline{2-2} 29 & 272 \\ & 261 \\ \cline{2-2} 383 & 1149 \\ & 1149 \\ \cline{2-2} \end{array} \qquad \begin{array}{r|r} & \dot{1}1\dot{6}6\dot{4}\,(108 \\ & 1 \\ \cline{2-2} 208 & 1664 \\ & 1664 \\ \cline{2-2} \end{array}$$

(4)

$$\begin{array}{r|r} & 9\dot{9}8\dot{0}0\dot{1}\,(999 \\ & 81 \\ \cline{2-2} 189 & 1880 \\ & 1701 \\ \cline{2-2} 1989 & 17901 \\ & 17901 \\ \cline{2-2} \end{array} \qquad \begin{array}{r|r} & 9\dot{7}8\dot{1}2\dot{1}\,(989 \\ & 81 \\ \cline{2-2} 188 & 1681 \\ & 1504 \\ \cline{2-2} 1969 & 17721 \\ & 17721 \\ \cline{2-2} \end{array} \qquad \begin{array}{r|r} & 8\dot{2}4\dot{4}6\dot{4}\,(908 \\ & 81 \\ \cline{2-2} 1808 & 14464 \\ & 14464 \\ \cline{2-2} \end{array}$$

```
(5)       29̇50̇66̇24̇ (5432
          25
   104   | 450
         | 416
  1083   |  3466
         |  3249
 10862   |   21724
         |   21724
```

```
          14̇35̇65̇21̇ (3789
          9
    67   | 535
         | 469
   748   |  6665
         |  5984
  7569   |   68121
         |   68121
```

```
          5̇34̇53̇44̇ (2312
          4
    43   | 134
         | 129
   461   |  553
         |  461
  4622   |   9244
         |   9244
```

```
(6)       2̇36̇14̇46̇89̇ (15367
          1
    25   | 136
         | 125
   303   |  1114
         |   909
  3066   |  20546
         |  18396
 30727   |   215089
         |   215089
```

```
          28̇24̇29̇53̇64̇81̇ (531441
          25
    103  | 324
         | 309
   1061  |  1529
         |  1061
  10624  |  46853
         |  42496
 106284  |   435764
         |   425136
1062881  |    1062881
         |    1062881
```

```
          2̇82̇47̇52̇49̇ (16807
          1
    26   | 182
         | 156
   328   |  2647
         |  2624
 33607   |   235249
         |   235249
```

```
(7)       29̇50̇66̇24̇00̇00̇ (543200
          25
   104   | 450
         | 416
  1083   |  3466
         |  3249
 10862   |   21724
         |   21724
         |        0000
```

```
          4̇16̇05̇80̇06̇25̇00̇ (2039750
          4
    403  | 1605
         | 1209
   4069  |  39680
         |  36621
  40787  |   305906
         |   285509
 407945  |    2039725
         |    2039725
         |           00
```

```
2.  (1)   16̇7̇·96̇16̇ (12·96
          1
    22   | 67
         | 44
   249   | 2396
         | 2241
  2586   |  15516
         |  15516
```

```
          28̇·83̇69̇ (5·37
          25
   103   | 383
         | 309
  1067   |  7469
         |  7469
```

	57648·01 (240·1
	4
44	176
	176
4801	4801
	4801

(2)

	·3486784401 (·59049
	25
109	986
	981
11804	57844
	47216
118089	1062801
	1062801

	39·15380329 (6·2573
	36
122	315
	244
1245	7138
	6225
12507	91303
	87549
125143	375429
	375429

(3)

	·042849 (·207
	4
407	2849
	2849

	·00139876 (·0374
	9
67	498
	469
744	2976
	2976

	·00203401 (·0451
	16
85	434
	425
901	901
	901

(4)

	5774409 (2403
	4
44	177
	176
4803	14409
	14409

	5·774409 (2·403
	4
44	177
	176
4803	14409
	14409

(5)

	120888·68379025 (347·6905
	9
64	308
	256
687	5288
	4809
6946	47968
	41676
69529	629237
	625761
6953805	34769025
	34769025

	240398·012416 (490·304
	16
89	803
	801
9803	29801
	29409
98064	3922416
	3922416

3. (1) 16 (4
16

	1·6000000 (1·2649...
	1
22	60
	44
246	1600
	1476
2524	12400
	10096
25289	230400
	227601
	2799

```
·16 (·4
 16
```

```
        ·01600000 (·1264...
         1
    22 | 60
       | 44
   246 | 1600
       | 1476
  2524 |  12400
       |  10096
           2344
```

(2)

```
       235·60000000 (15·3492...
       1
    25 | 135
       | 125
   303 | 1060
       |  909
  3064 | 15100
       | 12256
 30689 |  284400
       |  276001
306982 |     839900
       |     613964
             225936
```

```
       ·10000000 (·3162...
         9
    61 | 100
       |  61
   626 | 3900
       | 3756
  6322 |  14400
       |  12644
           1756
```

```
·01 (·1
  1
```

```
          ·50000000 (·7071...
           49
   1407 | 10000
        |  9849
  14141 |  15100
        |  14141
             959
```

```
          5·00000000 (2·2360...
          4
     42 | 100
        | 84
    443 | 1600
        | 1329
   4466 |  27100
        |  26796
   4472 |    31400
```

(3)

```
·0004 (·02
    4
```

```
        ·00081000 (·0284...
            4
     48 | 410
        | 384
    564 |  2600
        |  2256
            344
```

```
         379·86400000 (19·4901...
         1
     29 | 279
        | 261
    384 | 1886
        | 1536
   3889 |  35040
        |  35001
 389801 |      390000
        |      389801
                  199
```

(4)

$$\sqrt{20\tfrac{1}{4}}=\sqrt{\frac{81}{4}}=\frac{9}{2}=4\tfrac{1}{2}.$$

$$\sqrt{153\tfrac{7}{9}}=\sqrt{\frac{1384}{9}}=\frac{37\cdot2021\ldots}{3}=12\cdot4007\ldots$$

$$\sqrt{\tfrac{1}{3}}=\sqrt{\cdot33\dot{3}\ldots}=\cdot5773\ldots$$

$$\begin{array}{r|l} & 2\dot{2}0\dot{9}\,(47 \\ & 16 \\ \hline 87 & 609 \\ & 609 \\ \hline \end{array} \qquad \begin{array}{r|l} & 9\dot{8}0\dot{1}\,(99 \\ & 81 \\ \hline 189 & 1701 \\ & 1701 \\ \hline \end{array}$$

$$\therefore \sqrt{\frac{2209}{9801}} = \frac{47}{99}.$$

(5) $$\sqrt{\frac{3}{5}} = \sqrt{\left(\frac{3 \times 5}{5 \times 5}\right)} = \frac{\sqrt{15}}{5} = \frac{3\cdot8729\ldots}{5} = \cdot7745\ldots$$

$$\sqrt{\frac{1}{17}} = \sqrt{\left(\frac{1 \times 17}{17 \times 17}\right)} = \frac{\sqrt{17}}{17} = \frac{4\cdot12310\ldots}{17} = \cdot2425\ldots$$

$$\sqrt{2\tfrac{1}{6}} = \sqrt{2\cdot166\dot{6}\ldots} = 1\cdot4719\ldots$$

$$\sqrt{\frac{3\frac{1}{2}}{4\frac{1}{2}}} = \sqrt{\frac{7}{9}} = \frac{\sqrt{7}}{3} = \frac{2\cdot6457\ldots}{3} = \cdot8819\ldots$$

(6) $$\sqrt{\frac{5\cdot04}{\cdot021}} = \sqrt{\frac{5040}{21}} = \sqrt{240} = 15\cdot4919\ldots$$

$$\sqrt{1\tfrac{56}{169}} = \sqrt{\frac{225}{169}} = \frac{25}{13} = 1\tfrac{2}{13}.$$

$$\begin{array}{r|l} & 2\dot{3}\cdot\dot{1}0\dot{0}0\dot{0}0\dot{0}0\,(4\cdot8062\ldots \\ & 16 \\ \hline 88 & 710 \\ & 704 \\ \hline 9606 & 60000 \\ & 57636 \\ \hline 96122 & 236400 \\ & 192244 \\ \hline & 44156 \end{array} \qquad \begin{array}{r|l} & 4\dot{2}\cdot\dot{0}0\dot{0}0\dot{0}0\dot{0}0\,(6\cdot4807\ldots \\ & 36 \\ \hline 124 & 600 \\ & 496 \\ \hline 1288 & 10400 \\ & 10304 \\ \hline 129607 & 960000 \\ & 907249 \\ \hline & 52751 \end{array}$$

4. $$\begin{array}{r|l} & \cdot0\dot{0}1\dot{9}1\dot{4}0\dot{6}2\dot{5}\,(\cdot04375 \\ & 16 \\ \hline 85 & 314 \\ & 249 \\ \hline 867 & 6506 \\ & 6069 \\ \hline 8745 & 43725 \\ & 43725 \\ \hline \end{array}$$

and $$\cdot04375 = \frac{4375}{100000} = \frac{875}{20000} = \frac{175}{4000} = \frac{35}{800} = \frac{7}{160}.$$

5. Area of rectangular field

= (700 × 2800) sq. yds. = 1960000 sq. yds.;

∴ side of square field = $\sqrt{1960000}$ = 1400 yds.

(6)

$$\begin{array}{l} \text{ac.}\quad \text{ro.}\quad \text{po.}\quad \text{sq. yds.}\\ 1\ .\ 0\ .\ 22\ .\ 7\tfrac{9}{16}.\\ \underline{4}\\ 4\ \text{ro.}\\ \underline{40}\\ 182\ \text{po.}\\ \underline{\ \ 30\tfrac{1}{4}}\\ 5460\\ \ \ 45\tfrac{1}{2}\\ \underline{\ \ \ 7\tfrac{9}{16}}\\ 5513\tfrac{1}{16}\ \text{sq. yds.} \end{array}$$

$$\therefore \text{side of field} = \sqrt{5513\tfrac{1}{16}} = \sqrt{\frac{88209}{16}} = \frac{297}{4} = 74\tfrac{1}{4}\ \text{yards.}$$

(7)

$$(\text{Diagonal})^2 = (\text{length})^2 + (\text{breadth})^2 = (225)^2 + (120)^2$$
$$= 50625 + 14400 = 65025;$$
$$\therefore \text{diagonal} = \sqrt{65025} = 255\ \text{yards.}$$

(8) 8*d.* : £27. 1*s.* 6*d.* :: 1 sq. yard : no. of sq. yards in enclosure;

$$\therefore \text{area} = \frac{6498}{4}\ \text{sq. yds.} = \frac{3249}{4}\ \text{sq. yds.};$$
$$\therefore \text{length of side} = \sqrt{\frac{3249}{4}} = \frac{57}{2} = 28\tfrac{1}{2}\ \text{yds.}$$

(9)

$$(\text{hypothenuse})^2 = (\text{perpendicular})^2 + (\text{base})^2,$$
$$\text{or}\ \ (51)^2 = (24)^2 + (\text{base})^2;$$
$$\therefore (\text{base})^2 = 2601 - 576 = 2025;$$
$$\therefore \text{base} = \sqrt{2025} = 45\ \text{yards.}$$

(10)

$$(\text{Length of ladder})^2 = (\text{width of path})^2 + (\text{height to which ladder reaches})^2,$$
$$\text{or}\ \ (91)^2 = (35)^2 + (\text{height})^2;$$
$$\therefore (\text{height})^2 = 8281 - 1225 = 7056;$$
$$\therefore \text{height} = \sqrt{7056} = 84\ \text{ft.};$$
$$\therefore \text{height of building} = 84\ \text{ft. } 9\ \text{in.}$$

(11)

$$\begin{array}{r|r} & \cdot 0\dot{0}5\dot{0}7\dot{2}2\dot{8}8\dot{4}\ (\cdot 07122\\ & 49\\ \hline 141 & 172\\ & 141\\ \hline 1422 & 3128\\ & 2844\\ \hline 14242 & 28484\\ & 28484\\ \hline \end{array}$$

$$\begin{array}{r} 4840\ \text{sq. yds.} = 1\ \text{acre}\\ \underline{2}\\ 9680\\ \underline{9}\\ 87120\\ \underline{144}\\ 348480\\ 348480\ \\ \underline{87120\ \ }\\ 1\dot{2}5\dot{4}5\dot{2}8\dot{0}\ (3541\ \text{inches} \end{array}$$

$$\begin{array}{r|r} & 9\\ \hline 65 & 354\\ & 325\\ \hline 704 & 2952\\ & 2816\\ \hline 7081 & 13680\\ & 7081\\ \hline & 6599 \end{array}$$

$$\begin{array}{r|l} 12 & 3541\ \text{in.}\\ \hline 3 & 295 - 1\\ \hline \end{array}$$
$$\text{yds. } 98 \quad 1\ \text{ft. } 1\ \text{in.}$$

(12) In 6 hours one travels 72 miles,

.... the other .... 54 ......;

and, since they go in directions at right angles to each other,

$$(\text{distance required})^2 = (72)^2 + (54)^2 = 5184 + 2916 = 8100;$$

therefore distance required $= \sqrt{(8100)} = 90$ miles.

(13) $(\text{Length of one part of street})^2 = (36)^2 - (28)^2 = 1296 - 784 = 512;$

therefore length of one part $= \sqrt{(512)} = 22\cdot62...$ ft.,

and $(\text{length of other part of street})^2 = (36)^2 - (26)^2 = 1296 - 676 = 620;$

therefore length of other part $= \sqrt{(620)} = 24\cdot89...$ ft.;

therefore length of street $= (22\cdot62... + 24\cdot89...)$ ft. $= 47\cdot5...$ ft.

(14) £45. 18*s.* 9*d.* = 11025*d.*;

therefore $(\text{number of members})^2 = 11025;$

therefore number of members $= \sqrt{(11025)} = 105.$

(15)

$$\begin{array}{r|l}
 & 295066\cdot24\ (543\cdot2\text{ yds.} \\
 & 25 \\
104 & 450 \\
 & 416 \\
1083 & 3466 \\
 & 3249 \\
10862 & 21724 \\
 & 21724
\end{array}$$

CUBE ROOT.

Ex. LXVII. (p. 271.)

1. (1)

$$\begin{array}{r|l}
 & \dot{1}72\dot{8}\ (12 \\
 & 1 \\
3\times1^2=3 & 728 \\
3\times(10)^2=300 & \\
3\times10\times2=\ \ 60 & \\
2^2=\ \ \ 4 & \\
364 & \\
2 & \\
728 & 728
\end{array}
\qquad\qquad
\begin{array}{r|l}
 & \dot{3}37\dot{5}\ (15 \\
 & 1 \\
3\times1^2=3 & 2375 \\
3\times(10)^2=300 & \\
3\times10\times5=150 & \\
5^2=\ \ 25 & \\
475 & \\
5 & \\
2375 & 2375
\end{array}$$

$$
\begin{array}{r|l}
 & 2\dot{9}79\dot{1}\ (31 \\
 & 27 \\ \hline
3\times3^2=27 & 2791 \\
3\times(30)^2=2700 & \\
3\times30\times1=90 & \\
1^2=\underline{1} & \\
2791 & \underline{2791}
\end{array}
$$

(2)

$$
\begin{array}{r|l}
 & 5\dot{4}87\dot{2}\ (38 \\
 & 27 \\ \hline
3\times3^2=27 & 27872 \\
3\times(30)^2=2700 & \\
3\times30\times8=720 & \\
8^2=\underline{64} & \\
3484 & \\
\underline{8} & \\
27872 & \underline{27872}
\end{array}
\qquad
\begin{array}{r|l}
 & 11\dot{0}59\dot{2}\ (48 \\
 & 64 \\ \hline
3\times4^2=48 & 46592 \\
3\times(40)^2=4800 & \\
3\times40\times8=960 & \\
8^2=\underline{64} & \\
5824 & \\
\underline{8} & \\
46592 & \underline{46592}
\end{array}
$$

$$
\begin{array}{r|l}
 & 30\dot{0}76\dot{3}\ (67 \\
 & 216 \\ \hline
3\times6^2=108 & 84763 \\
3\times(60)^2=10800 & \\
3\times60\times7=1260 & \\
7^2=\underline{49} & \\
12109 & \\
\underline{7} & \\
84763 & \underline{84763}
\end{array}
$$

(3)

$$
\begin{array}{r|l}
 & 68\dot{1}47\dot{2}\ (88 \\
 & 512 \\ \hline
3\times8^2=192 & 169472 \\
3\times(80)^2=19200 & \\
3\times80\times8=1920 & \\
8^2=\underline{64} & \\
21184 & \\
\underline{8} & \\
169472 & \underline{169472}
\end{array}
\qquad
\begin{array}{r|l}
 & 80\dot{4}35\dot{7}\ (93 \\
 & 729 \\ \hline
3\times9^2=243 & 75357 \\
3\times(90)^2=24300 & \\
3\times90\times3=810 & \\
3^2=\underline{9} & \\
25119 & \\
\underline{3} & \\
75357 & \underline{75357}
\end{array}
$$

$$
\begin{array}{r|l}
 & 94\dot{1}19\dot{2}\ (98 \\
 & 729 \\ \hline
3\times9^2=243 & 212192 \\
3\times(90)^2=24300 & \\
3\times90\times8=2160 & \\
8^2=\underline{64} & \\
26524 & \\
\underline{8} & \\
212192 & \underline{212192}
\end{array}
$$

(4)

	$\dot{2}40\dot{6}10\dot{4}$ (134
	1
$3\times1^2=3$	1406
$3\times(10)^2=300$	
$3\times10\times3=\ 90$	
$3^2=\ 9$	
399	
3	
1197	1197
$3\times(13)^2=507$	209104
$3\times(130)^2=50700$	
$3\times130\times4=\ 1560$	
$4^2=\ 16$	
52276	
4	
209104	209104

	$6\dot{9}42\dot{6}53\dot{1}$ (411
	64
$3\times4^2=48$	5426
$3\times(40)^2=4800$	
$3\times40\times1=\ 120$	
$1^2=\ 1$	
4921	4921
$3\times(41)^2=5043$	505531
$3\times(410)^2=504300$	
$3\times410\times1=\ 1230$	
$1^2=\ 1$	
505531	505531

	$\dot{8}36\dot{5}42\dot{7}$ (203
	8
$3\times2^2=\ 12$	365427
$3\times(20)^2=1200$	
$3\times(200)^2=120000$	
$3\times200\times3=\ 1800$	
$3^2=\ 9$	
121809	
3	
365427	365427

(5)

	$25\dot{1}23\dot{9}59\dot{1}$ (631
	216
$3\times6^2=108$	35239
$3\times(60)^2=10800$	
$3\times60\times3=\ 540$	
$3^2=\ 9$	
11349	
3	
34047	34047
$3\times(63)^2=11907$	1192591
$3\times(630)^2=1190700$	
$3\times630\times1=\ 1890$	
$1^2=\ 1$	
1192591	1192591

	$2\dot{8}37\dot{2}62\dot{5}$ (305
	27
$3\times3^2=\ 27$	1372625
$3\times(30)^2=2700$	
$3\times(300)^2=270000$	
$3\times300\times5=\ 4500$	
$5^2=\ 25$	
274525	
5	
1372625	1372625

48228544 (364
27

$3\times(3)^2=27$ | 21228
$3\times(30)^2=2700$
$3\times30\times6=540$
$6^2=36$
3276
6
19656 | 19656

$3\times(36)^2=3888$ | 1572544
$3\times(360)^2=388800$
$3\times360\times4=4320$
$4^2=16$
393136
4
1572544 | 1572544

3)

17173512 (258
8

$3\times2^2=12$ | 9173
$3\times(20)^2=1200$
$3\times20\times5=300$
$5^2=25$
1525
5
7625 | 7625

$3\times(25)^2=1875$ | 1548512
$3\times(250)^2=187500$
$\times250\times8=6000$
$8^2=64$
193564
8
1548512 | 1548512

259694072 (638
216

$3\times6^2=108$ | 43694
$3\times(60)^2=10800$
$3\times60\times3=540$
$3^2=9$
11349
3
34047 | 34047

$3\times(63)^2=11907$ | 9647072
$3\times(630)^2=1190700$
$3\times630\times8=15120$
$8^2=64$
1205884
8
9647072 | 9647072

926859375 (975
729

$3\times9^2=243$ | 197859
$3\times(90)^2=24300$
$3\times90\times7=1890$
$7^2=49$
26239
7
183673 | 183673

$3\times(97)^2=28227$ | 14186375
$3\times(970)^2=2822700$
$3\times970\times5=14550$
$5^2=25$
2837275
5
14186375 | 14186375

(7)

$2\dot{7}05\dot{4}03\dot{6}00\dot{8}$ (3002
27

$3 \times 3^2 = 27$
$3 \times (30)^2 = 2700$
$3 \times (300)^2 = 270000$
$3 \times (3000)^2 = 27000000$
$3 \times 3000 \times 2 = 18000$
$2^2 = 4$
27018004
2
54036008

54036008
54036008

$21\dot{9}36\dot{5}32\dot{7}79\dot{1}$ (60
216

$3 \times 6^2 = 108$
$3 \times (60)^2 = 10800$
$3 \times (600)^2 = 1080000$
$3 \times 600 \times 3 = 5400$
$3^2 = 9$
1085409
3
3256227

3365327
3256227

$3 \times (603)^2 = 1090827$
$3 \times (6030)^2 = 109082700$
$3 \times 6030 \times 1 = 18090$
$1^2 = 1$
109100791

109100791
109100791

2.

$\cdot 38\dot{9}01\dot{7}$ (·73
343

$3 \times 7^2 = 147$
$3 \times (70)^2 = 14700$
$3 \times 70 \times 3 = 630$
$3^2 = 9$
15339
3
46017

46017
46017

$3\dot{2} \cdot 46\dot{1}75\dot{9}$ (3·1
27

$3 \times (3)^2 = 27$
$3 \times (30)^2 = 2700$
$3 \times 30 \times 1 = 90$
$1^2 = 1$
2791

5461
2791

$3 \times (31)^2 = 2883$
$3 \times (310)^2 = 288300$
$3 \times 310 \times 9 = 8370$
$9^2 = 81$
296751
9
2670759

2670759
2670759

$9\dot{5}44\dot{3} \cdot 99\dot{3}$ (45·7
64

$3 \times 4^2 = 48$
$3 \times (40)^2 = 4800$
$3 \times 40 \times 5 = 600$
$5^2 = 25$
5425
5
27125

31443
27125

$3 \times (45)^2 = 6075$
$3 \times (450)^2 = 607500$
$3 \times 450 \times 7 = 9450$
$7^2 = 49$
616999
7
4318993

4318993
4318993

$\cdot 00\dot{1}90\dot{6}62\dot{4}$ (·124
1

$3 \times 1^2 = 3$
$3 \times (10)^2 = 300$
$3 \times 10 \times 2 = 60$
$2^2 = 4$
364
2
728

906
728

$3 \times (12)^2 = 432$
$3 \times (120)^2 = 43200$
$3 \times 120 \times 4 = 1440$
$4^2 = 16$
44656
4
178624

178624
178624

·000912673 (·097
729
$3 \times 9^2 = 243$ | 183673
$\times (90)^2 = 24300$
$90 \times 7 = 1890$
$7^2 = 49$
26239
7
183673 | 183673

·000024389 (·029
8
$3 \times 2^2 = 12$ | 16389
$3 \times (20)^2 = 1200$
$3 \times 20 \times 9 = 540$
$9^2 = 81$
1821
9
16389 | 16389

3·000000000 (1·442...
1
$3 \times 1^2 = 3$ | 2000
$3 \times (10)^2 = 300$
$3 \times 10 \times 4 = 120$
$4^2 = 16$
436
4
1744 | 1744
256000
$3 \times (14)^2 = 588$
$(140)^2 = 58800$
$140 \times 4 = 1680$
$4^2 = 16$
60496
4
241984 | 241984
14016000
$3 \times (144)^2 = 62208$
$)^2 = 6220800$
$2 = 8640$
$2^2 = 4$
6229444
2
12458888 | 12458888
1557112

·300000000 (·669...
216
$3 \times 6^2 = 108$ | 84000
$3 \times (60)^2 = 10800$
$3 \times 60 \times 6 = 1080$
$6^2 = 36$
11916
6
71496 | 71496
12504000
$3 \times (66)^2 = 13068$
$3 \times (660)^2 = 1306800$
$3 \times 660 \times 9 = 17820$
$9^2 = 81$
1324701
9
11922309 | 11922309
581691

·030000000 (·310...
27
$3 \times 3^2 = 27$ | 3000
$3 \times (30)^2 = 2700$
$3 \times 30 \times 1 = 90$
$1^2 = 1$
2791 | 2791
$3 \times (31)^2 = 2883$ | 209000

(2) $\sqrt[3]{\left(\frac{8}{27}\right)}=\frac{2}{3}$;

$\sqrt[3]{\left(\frac{250}{646}\right)}=\sqrt[3]{\left(\frac{125}{343}\right)}=\frac{5}{7}$;

(3) $\sqrt[3]{(405\frac{28}{125})}=\sqrt[3]{\left(\frac{50653}{125}\right)}$

$=\frac{37}{5}=7\frac{2}{5}$;

$$\begin{array}{r|l}
 & 4\dot{4}\cdot60\dot{0}00\dot{0}00\dot{0}\ (3\cdot546\ldots \\
 & 27 \\ \hline
3\times3^2=27 & 17600 \\
3\times(30)^2=2700 & \\
3\times30\times5=\ \ 450 & \\
5^2=\ \ \ 25 & \\
3175 & \\
5 & \\
15875 & 15875 \\ \hline
3\times(35)^2=3675 & 1725000 \\
3\times(350)^2=367500 & \\
3\times350\times4=\ \ 4200 & \\
4^2=\ \ \ 16 & \\
371716 & \\
4 & \\
1486864 & 1486864 \\ \hline
3\times(354)^2=376948 & 23813600 \\
3\times(3540)^2=37694800 & \\
3\times3540\times6=\ \ 63720 & \\
6^2=\ \ \ 36 & \\
37758556 & \\
6 & \\
226551336 & 226551336 \\ \hline
 & 11584664
\end{array}$$

Since

$$\begin{array}{r|l}
 & 5\dot{0}65\dot{3}\ (37 \\
 & 27 \\ \hline
3\times3^2=27 & 23653 \\
3\times(30)^2=2700 & \\
3\times30\times7=\ \ 630 & \\
7^2=\ \ \ 49 & \\
3379 & \\
7 & \\
23653 & 23653 \\ \hline
\end{array}$$

$\sqrt[3]{(7\frac{1}{5})}=\sqrt[3]{(7\cdot2)}$; and

$$\begin{array}{r|l}
 & \dot{7}\cdot20\dot{0}00\dot{0}00\dot{0}\ (1\cdot930\ldots \\
 & 1 \\ \hline
3\times1^2=3 & 6200 \\
3\times(10)^2=300 & \\
3\times10\times9=270 & \\
9^2=\ \ 81 & \\
651 & \\
9 & \\
5859 & 5859 \\ \hline
3\times(19)^2=1083 & 341000 \\
3\times(190)^2=108300 & \\
3\times190\times3=\ \ 1710 & \\
3^2=\ \ \ 9 & \\
110019 & \\
3 & \\
330057 & 330057 \\ \hline
3\times(193)^2=111747 & 10943000
\end{array}$$

$$\begin{array}{r|r}
 & \dot{3}\cdot00\dot{4}15\dot{0}00\dot{0}\ (1\cdot442\ldots \\
 & 1 \\ \hline
3\times1^2=3 & 2004 \\
3\times(10)^2=300 & \\
3\times10\times4=120 & \\
4^2=\ \ 16 & \\ \hline
436 & \\
4 & \\ \hline
1744 & 1744 \\ \hline
3\times(14)^2=588 & 260150 \\
3\times(140)^2=58800 & \\
3\times140\times4=\ \ 1680 & \\
4^2=\ \ \ \ 16 & \\ \hline
60496 & \\
4 & \\ \hline
241984 & 241984 \\ \hline
3\times(144)^2=62208 & 18166000 \\
3\times(1440)^2=6220800 & \\
3\times1440\times2=\ \ \ \ 8640 & \\
2^2=\ \ \ \ \ \ 4 & \\ \hline
6229444 & \\
2 & \\ \hline
12458888 & 12458888 \\ \hline
 & 5707112
\end{array}$$

(4)

$$\begin{array}{r|r}
 & \cdot00\dot{0}10\dot{0}00\dot{0}\ (\cdot046\ldots \\
 & 64 \\ \hline
3\times4^2=48 & 36000 \\
3\times(40)^2=4800 & \\
3\times40\times6=\ \ 720 & \\
6^2=\ \ \ 36 & \\ \hline
5556 & \\
6 & \\ \hline
33336 & 33336 \\ \hline
 & 2664
\end{array}$$

Since $\frac{1257\cdot728}{16384}=\frac{157\cdot216}{2048}$

$$=\frac{19\cdot652}{256}=\frac{4\cdot913}{64};$$

$$\therefore \sqrt[3]{\left(\frac{1257\cdot728}{16384}\right)}=\sqrt[3]{\left(\frac{4\cdot913}{64}\right)}$$

$$=\frac{1\cdot7}{4}=\cdot425.$$

4.

$$\begin{array}{r|r}
 & 23\dot{3}\cdot74\dot{4}89\dot{6}\ (6\cdot16 \\
 & 216 \\ \hline
3\times6^2=108 & 17744 \\
3\times(60)^2=10800 & \\
3\times60\times1=\ \ \ 180 & \\
1^2=\ \ \ \ \ 1 & \\ \hline
10981 & 10981 \\ \hline
3\times(61)^2=11163 & 6763896 \\
3\times(610)^2=1116300 & \\
3\times610\times6=\ \ \ 10980 & \\
6^2=\ \ \ \ \ 36 & \\ \hline
1127316 & \\
6 & \\ \hline
6763896 & 6763896 \\ \hline
\end{array}$$

$$\sqrt[3]{(233\cdot744896\times\cdot008)}$$

$$=6\cdot16\times\cdot2$$

$$=1\cdot232.$$

5. Number of cubic inches in mass $= \frac{£10481.\ 1s.\ 4d.}{10s.\ 5d.} = \frac{2515456}{125} = 20123\cdot648.$

$$\begin{array}{r|l}
 & 2\dot{0}12\dot{3}\cdot64\dot{8}\ (27\cdot2 \text{ inches} = \text{edge of cube} \\
 & 8 \\ \hline
3\times2^2=12 & 12123 \\
3\times(20)^2=1200 & \\
3\times20\times7=\ \ 420 & \\
7^2=\ \ \ \ 49 & \\ \cline{1-1}
1669 & \\
7 & \\ \cline{1-1}
11683 & 11683 \\ \hline
3\times(27)^2=2187 & 440648 \\
3\times(270)^2=218700 & \\
3\times270\times2=\ \ \ 1620 & \\
2^2=\ \ \ \ \ \ \ 4 & \\ \cline{1-1}
220324 & \\
2 & \\ \cline{1-1}
440648 & 440648 \\ \hline
\end{array}$$

6.

$$\begin{array}{r|l}
 & 5\dot{6}65\dot{3}\ (37 \\
 & 27 \\ \hline
3\times3^2=27 & 23653 \\
3\times(30)^2=2700 & \\
3\times30\times7=\ \ 630 & \\
7^2=\ \ \ 49 & \\ \cline{1-1}
3379 & \\
7 & \\ \cline{1-1}
23653 & 23653 \\ \hline
\end{array}$$

∴ area $=(37\times37)$ sq. ft. $=1369$ sq. ft.

7. 56 cub. ft. 568 cub. in. = 97336 cubic inches.

$$\begin{array}{r|l}
 & 9\dot{7}33\dot{6}\ (46 \text{ inches} = 3 \text{ ft. } 10 \text{ in.} \\
 & 64 \\ \hline
3\times4^2=48 & 33336 \\
3\times(40)^2=4800 & \\
3\times40\times6=\ \ 720 & \\
6^2=\ \ \ 36 & \\ \cline{1-1}
5556 & \\
6 & \\ \cline{1-1}
33336 & 33336 \\ \hline
\end{array}$$

8.

$$\begin{array}{r|l}
 & 2\dot{1}71\dot{7}\cdot63\dot{9}\ (27\cdot9 \text{ feet} \\
 & 8 \\ \hline
3\times2^2=12 & 13717 \\
3\times(20)^2=1200 & \\
3\times20\times7=\ \ 420 & \\
7^2=\ \ \ 49 & \\ \cline{1-1}
1669 & \\
7 & \\ \cline{1-1}
11683 & 11683 \\ \hline
3\times(27)^2=2187 & 2034639 \\
3\times(270)^2=218700 & \\
3\times270\times9=\ \ \ 7290 & \\
9^2=\ \ \ \ \ \ 81 & \\ \cline{1-1}
226071 & \\
9 & \\ \cline{1-1}
2034639 & 2034639 \\ \hline
\end{array}$$

Therefore area of floor $= (27\cdot 9 \times 27\cdot 9)$ sq. ft. $= 778\cdot 41$ sq. ft.;

therefore (length of carpet in feet) $\times \frac{21}{12} = 778\cdot 41$;

therefore length of carpet in yards $= \frac{778\cdot 41 \times 12}{3 \times 21}$;

therefore cost of carpet $= \frac{778\cdot 41 \times 12 \times 42}{3 \times 21}\,d.$

$= (778\cdot 41 \times 8)d. = £25.\ 18s.\ 11\frac{7}{25}d.$

9.

$$\begin{array}{r|l}
 & 94\dot{1}19\dot{2}\ (98 \text{ inches} \\
 & 729 \\
\hline
3\times 9^2 = 243 & 212192 \\
3\times (90)^2 = 24300 & \\
3\times 90\times 8 = 2160 & \\
8^2 = 64 & \\
\overline{26524} & \\
8 & \\
\overline{212192} & 212192 \\
\hline
\end{array}$$

Therefore area of one side $= (98 \times 98)$ sq. inches;

therefore area of 6 sides $= (6 \times 98 \times 98)$ sq. inches;

therefore cost required $= \frac{6 \times 98 \times 98 \times 6}{12 \times 12}\,d. = 2401d. = £10.\ 0s.\ 1d.$

10. 37 cub. ft. 64 cub. in. $= 64000$ cub. in.,

and $\sqrt[3]{(64000)} = 40$ in.;

therefore area of 6 sides $= (6 \times 40 \times 40)$ sq. in. $= 66$ sq. ft. 96 sq. in.

11. Cubic feet in smaller vessel $= 8$;

therefore cubic feet in larger vessel $= 24$.

$$\begin{array}{r|l}
 & 2\dot{4}\cdot 00\dot{0}\ (2\cdot 8\ldots\text{ft.} \\
 & 8 \\
\hline
3\times 2^2 = 12 & 16000 \\
3\times (20)^2 = 1200 & \\
3\times 20\times 8 = 480 & \\
8^2 = 64 & \\
\overline{1744} & \\
8 & \\
\overline{13952} & 13952 \\
\hline
 & 2048
\end{array}$$

12.

$$\begin{array}{r|l}
 & 4\dot{3}0\dot{4}6\dot{7}2\dot{1}\ (6561 \\
 & 36 \\ \hline
125 & 704 \\
 & 625 \\ \hline
1306 & 7967 \\
 & 7836 \\ \hline
13121 & 13121 \\
 & 13121 \\ \hline
\end{array}
\qquad
\begin{array}{r|l}
 & \cdot 0\dot{0}0\dot{0}0\dot{0}0\dot{0}4\dot{0}9\dot{6}\ (\cdot 000064 \\
 & 36 \\ \hline
124 & 496 \\
 & 496 \\ \hline
\end{array}$$

$$\begin{array}{l}
\cdot 0\dot{0}0\dot{0}6\dot{4}\ (\cdot 04 \\
\underline{64}
\end{array}$$

$$\begin{array}{r|l}
 & 6\dot{5}6\dot{1}\ (81 \\
 & 64 \\ \hline
161 & 161 \\
 & 161 \\ \hline
\end{array}$$

MISCELLANEOUS QUESTIONS AND EXAMPLES.

Ex. LXX. (p. 283.)

I.

1.

$$\begin{array}{r}
\pounds \\
\cdot 96 \\
\cdot 535 \\ \hline
\cdot 425 \\
8 \\ \hline
\pounds 3\cdot 400
\end{array} = \pounds 3.\ 4\text{ fl.} = \pounds 3.\ 8s.$$

2.

$$\begin{array}{rrrrr}
s. & d. & \pounds & s. & d. \\
18\ . & 6 \times 6\frac{3}{4} = & 6\ . & 4\ . & 10\frac{1}{2} \\
5\ . & 4 \times 10\frac{3}{4} = & 2\ . & 17\ . & 4 \\
56 & \times 5\frac{3}{8} = & 15\ . & 1\ . & 0 \\ \cline{3-5}
 & & \pounds 24\ . & 3\ . & 2\frac{1}{2}
\end{array}$$

Now $1+2+3+4=10$

and $\dfrac{\pounds 24.\ 3s.\ 2\frac{1}{2}d.}{10} = \pounds 2.\ 8s.\ 3\frac{3}{4}d.\ \frac{2}{5}q.$, the share of the first person,

$\therefore$ share of second $= (\pounds 2.\ 8s.\ 3\frac{3}{4}d.\ \frac{2}{5}q.) \times 2 = \pounds 4.\ 16s.\ 7\frac{1}{2}d.\ \frac{4}{5}q.$

$\therefore$ share of third $= (\pounds 2.\ 8s.\ 3\frac{3}{4}d.\ \frac{2}{5}q.) \times 3 = \pounds 7.\ 4s.\ 11\frac{1}{2}d.\ \frac{1}{5}q.$

$\therefore$ share of fourth $= (\pounds 2.\ 8s.\ 3\frac{3}{4}d.\ \frac{2}{5}q.) \times 4 = \pounds 9.\ 13s.\ 3\frac{1}{4}d.\ \frac{3}{5}q.$

3. (*a*) Since $4\frac{14}{21} - 10\frac{44}{55} + 9\frac{3}{45} - \frac{52}{117}$

$$= 4\frac{2}{3} - 10\frac{4}{5} + 9\frac{1}{15} - \frac{4}{9} = \frac{112}{45}$$

$$\therefore \text{fraction required} = \frac{112}{45} \times \frac{1}{20 \times 12} = \frac{14}{45 \times 10 \times 3} = \frac{7}{675}.$$

(β) $$\frac{1}{3}\times\frac{17}{3}\times\frac{27}{85}+\left(2\tfrac{1}{3}+\cfrac{1}{3+\cfrac{1}{4}}\right)\times\frac{39}{103}$$

$$=\frac{3}{5}+\left(\frac{7}{3}+\frac{4}{13}\right)\times\frac{39}{103}=\frac{3}{5}+\frac{103}{39}\times\frac{39}{103}=\frac{3}{5}+1=1\tfrac{3}{5}.$$

4. Gross annual profits $=(£28.\ 3s.\ 2d.)\times 52=£1464.\ 4s.\ 8d.$

Payment to assistants $=(£7.\ 17s.\ 6d.)\times 52=£409.\ 10s.$

Yearly outgoings $=£361.\ 11s.\ 10d.$

$\therefore$ Net annual income $=£1464.\ 4s.\ 8d.-(£409.\ 10s.+£361.\ 11s.\ 10d.)$

$=£1464.\ 4s.\ 8d.-£771.\ 1s.\ 10d.$

$=£693.\ 2s.\ 10d.$

5. First to find the number of *men* required to do the second work:

$$\left.\begin{array}{rl} 20 : & 6 \\ 1\frac{3}{4} : & 6 \\ 8\ : & 14 \end{array}\right\} :: 10 : \text{number of men required,}$$

$$\therefore \text{number of men}=\frac{10\times 6\times 6\times 14}{20\times\frac{7}{4}\times 8}=18;$$

$\therefore$ 15 men will be required to help the 3 men.

$$\text{Now 1 man}=\frac{15}{10}\text{ boys,}$$

$$\therefore 15\text{ men}=\frac{15\times 15}{10}\text{ boys}=22\tfrac{1}{2}\text{ boys.}$$

Hence 23 boys will be required.

6. $$\text{Height}=\frac{12\times 4\frac{1}{6}\times 3\frac{1}{3}\times 2\frac{1}{2}}{8\frac{1}{3}\times 6\frac{2}{3}}\text{ ft.}$$

$$=\frac{12\times\frac{25}{6}\times\frac{10}{3}\times\frac{5}{2}}{\frac{25}{3}\times\frac{20}{3}}\text{ ft.}$$

$$=\frac{12\times 25\times 10\times 5\times 3\times 3}{25\times 20\times 6\times 3\times 2}\text{ ft.}=7\tfrac{1}{2}\text{ ft.}$$

7. Since $41{\cdot}06328\div{\cdot}0438=937{\cdot}5\ldots$

$\therefore$ 937 lines can be cut off.

Also, since $\cdot 0438\times 937=41{\cdot}0406$,

length of remaining line $=(41{\cdot}06328-41{\cdot}0406)$ in. $=\cdot 02268$ in.

8.

$$\begin{array}{rr|l}
\multicolumn{2}{r}{} & \multicolumn{1}{l}{73\dot{3}62\dot{6}75\dot{3}85\dot{9}\ (9019} \\
\multicolumn{2}{r}{} & \multicolumn{1}{l}{729} \\ \cline{3-3}
3\times(900)^2 = & 2430000 & 4626753 \\
3\times900\times1 = & 2700 & \\
1^2 = & 1 & \\ \cline{2-2}
 & 2432701 & \\
 & 1 & \\ \cline{2-2}
 & 2432701 & 2432701 \\ \cline{3-3}
3\times(9010)^2 = & 243540300 & 2194052859 \\
3\times9010\times9 = & 243270 & \\
9^2 = & 81 & \\ \cline{2-2}
 & 243783651 & \\
 & 9 & \\ \cline{2-2}
 & 2194052859 & 2194052859 \\ \cline{3-3}
\end{array}$$

There are 6 sides in the cube, and each of these is a perfect square whose side is 9019 inches.

$\therefore$ area of surface $= (9019 \times 9019 \times 6)$ sq. inches $= 488054166$ sq. inches.

9.

$$5 : 3\tfrac{1}{4} :: £100 : \text{price of a share},$$

$$\therefore \text{price of a share} = £\frac{100 \times 3\frac{1}{4}}{5} = £65.$$

He gives for 20 shares $(£20 \times 65) = £1300$,

and as he gains $(£20 \times 7)$, or £140, he has £1440 when he has sold out.

Now $90 : 1440 :: £3\tfrac{1}{4}$: his second income,

$$\therefore \text{second income} = £\frac{1440 \times 3\frac{1}{4}}{90} = £52.$$

Also his first income was $(£20 \times 3\tfrac{1}{4})$ or £65,

$\therefore$ he loses $(£65 - £52)$, or £13.

10. Since £100 will amount in 2 years to £108·16 at 4 per cent. compound interest,

$$108{\cdot}16 : 100 :: £845 : \text{sum required};$$

$$\therefore \text{sum required} = £\frac{100 \times 845}{108{\cdot}16} = £\frac{8450000}{10816} = £781.\ 5s.$$

Again, interest on £845 for 1 year at 4 per cent. $= £33{\cdot}8$,

and interest on £878·8 for 1 year at 4 per cent. $= £35{\cdot}152$;

$\therefore$ amount of £845 in 2 years $= (£845 + 33{\cdot}8 + 35{\cdot}152) = £913{\cdot}952$

$= £913.\ 19{\cdot}04s.$

11. Let £x = price he paid for each quarter.

Then $\frac{72x\times 108}{100}$ = what he sold 72 quarters for,

$\frac{37x\times 102}{100}$ = what he sold 37 quarters for,

$\frac{109x\times 110}{100}$ = sum he might have sold 110 quarters for;

$$\therefore \frac{72x\times 108}{100}+\frac{37x\times 112}{100}+2\tfrac{171}{240}=\frac{109x\times 110}{100};$$

$$\therefore 2\tfrac{171}{240}=\frac{11990x}{100}-\left(\frac{7776x}{100}+\frac{4144x}{100}\right);$$

$$\therefore \frac{651}{240}=\frac{70x}{100};$$

$$\therefore x=£\frac{651\times 100}{70\times 240}=£\frac{31}{8}=£3.\ 17s.\ 6d.$$

12. Since $41+56=97$, it follows that 3 per cent. of the receipts are reserved;

$\therefore$ 3 : 15000 :: £100 : gross receipts;

$\therefore$ gross receipts $=£\frac{15000\times 100}{3}=£500,000.$

Then 100 : 500000 :: £56 : amount paid to shareholders;

$\therefore$ amount paid to shareholders $=£\frac{500000\times 56}{100}=£280000;$

$\therefore$ $3\frac{1}{2}$: 280000 :: £100 : paid up capital;

$\therefore$ paid up capital $=£\frac{280000\times 100}{3\frac{1}{2}}=£8,000,000.$

II.

1. 1300000507364.

Two hundred and thirty-six billions, forty-five thousand nine hundred and seventy-eight millions, two hundred and thirteen thousand, four hundred and seventy-eight.

2. $24\frac{3}{4}$: 20 :: £1 : what he should have received;

$\therefore$ he should have received £$\frac{20}{24\frac{3}{4}}$, or £$\frac{20\times 4}{99}$, or $\frac{1600}{99}s.$;

$\therefore$ he was cheated of $\left(\frac{1600}{99}-15\right)s.$, or 16$s.$ $1\frac{3}{4}d.$ $\frac{75}{99}q.$ — 15$s.$, or 1$s.$ $1\frac{3}{4}d.$ $\frac{25}{33}q.$

3.

	£	s.	d.	
5s. = ¼	750 .	0 .	0	= value at £1 each.
			5	
	3750 .	0 .	0	= value at £5 each.
2s. 6d. = ½	187 .	5 .	0	= value at 5s. each.
10d. = ⅓	93 .	12 .	6	= value at 2s. 6d. each.
	31 .	4 .	2	= value at 10d. each.
	£4062 .	1 .	8	= value at £5. 8s. 4d. each.

	£	s.	d.	
2 qrs. = ½	3 .	7 .	6	= value of 1 cwt.
			3	
	10 .	2 .	6	= value of 3 cwt.
14 lbs. = ¼	1 .	18 .	9	= value of 2 qrs.
2 = $\frac{1}{7}$		8 .	$5\frac{1}{4}$	= value of 14 lbs.
2 = $\frac{1}{7}$		1 .	$2\frac{13}{28}$	= value of 2 lbs.
½ = ¼		1 .	$2\frac{13}{28}$	= value of 2 lbs.
			$3\frac{69}{112}$	= value of ½ lb.
	£12 .	7 .	$4\frac{3}{4}$. $\frac{5}{28}q.$	= value of 3 cwt. 2 qrs. 18½ lbs.

4. (α)

$$\frac{2\times\sqrt{1+\frac{1}{3}}\div\sqrt{1-\frac{1}{5}}}{5\times\sqrt{1+\frac{1}{3}}\times\sqrt{1-\frac{1}{5}}}=\frac{2\sqrt{\frac{4}{3}}\div\sqrt{\frac{4}{5}}}{5\sqrt{\frac{4}{3}}\times\sqrt{\frac{4}{5}}}$$

$$=\frac{2\sqrt{\frac{5}{3}}}{5\sqrt{\frac{16}{15}}}=\frac{2}{5}\cdot\sqrt{\frac{5\times15}{3\times16}}=\frac{2}{5}\sqrt{\frac{5\times5}{16}}$$

$$=\frac{2}{5}\cdot\frac{5}{4}=\frac{2}{4}=\frac{1}{2}.$$

(β)

$$\frac{2\frac{4}{11}}{2{\cdot}6}\div\frac{2\frac{7}{11}}{8{\cdot}7}=\frac{\frac{26}{11}}{\frac{26}{10}}\div\frac{\frac{29}{11}}{\frac{87}{10}}$$

$$=\frac{10}{11}\div\frac{10}{33}=\frac{33}{11}=3.$$

(γ) $\frac{2}{5}(6\frac{2}{3}+2\frac{1}{2})$£ $=(\frac{2}{5}$ of $9\frac{1}{6})$£ $=$ £$\frac{11}{3}$ = £3. 13s. 4d.

$$\frac{2\frac{1}{4}-\frac{2}{3}\text{ of }1\frac{5}{6}}{\frac{1}{5}\text{ of }3\frac{1}{3}+\frac{13}{36}}\text{ of }\frac{95}{100}\text{ of }5s.=\frac{\frac{9}{4}-\frac{11}{9}}{\frac{2}{3}+\frac{13}{36}}\text{ of }\frac{19}{20}\text{ of }5s.$$

$$=\frac{81-44}{24+13}\text{ of }\frac{19}{4}s.=\frac{19}{4}s.=4s.\ 9d.$$

$$\frac{16\cdot8}{\cdot024}d.=\frac{16800}{24}d.=700d.=£2.\ 18s.\ 4d.;$$

∴ sum required = £3. 13*s*. 4*d*. + 4*s*. 9*d*. + £2. 18*s*. 4*d*. = £6. 16*s*. 5*d*.

(δ) $\cdot0576\times1\cdot97=\cdot113472,$

$\cdot142857\times\frac{7}{15}=\cdot0095238\times7=\cdot0666666,$

and $\cdot113472+\cdot0666666+\cdot0454864=\cdot225625.$

Then $\sqrt{\cdot225625}=\cdot475,$

and $(\cdot475\times36)$ inches $=17\cdot1$ inches.

5. In one day *A* and *B* do $\frac{2}{3}$ of the work,

.... *A* and *C* do $\frac{1}{2}$ ....,

.... *B* and *C* do $\frac{1}{3}$ ....;

$$\therefore 2A \text{ and } 2B \text{ and } 2C \text{ do } \frac{2}{3}+\frac{1}{2}+\frac{1}{3}=\frac{3}{2};$$

$$\therefore A,\ B \text{ and } C \text{ do } \frac{3}{4};$$

∴ *C* does $\frac{3}{4}-\frac{2}{3}$, or $\frac{1}{12}$; ∴ *C* does the work in 12 days;

B ...... $\frac{3}{4}-\frac{2}{4}$, or $\frac{1}{4}$; ∴ *B* .... 4 days;

A ...... $\frac{3}{4}-\frac{1}{3}$, or $\frac{5}{12}$; ∴ *A* .... $2\frac{2}{5}$ days.

Again, in $\frac{12}{5}$ days *A* earns 6*s*., ∴ *A* earns $\frac{6\times5}{12}$ *s*., or 2*s*. 6*d*. daily;

.... in 4 days *B* ...... 6*s*., ∴ *B* .... $\frac{6}{4}$ *s*., or 1*s*. 6*d*. daily;

.... in 12 days *C* ...... 6*s*., ∴ *C* .... $\frac{6}{12}$ *s*., or 6*d*. daily.

6. $2500+3000+4200=9700.$

∴ 9700 : 2500 :: £530 : share of first town;

9700 : 3000 :: £530 : share of second town;

9700 : 4200 :: £530 : share of third town.

Hence, share of first town $=£\frac{2500\times530}{9700}=£136.\ 11s.\ 11\frac{49}{97}d.;$

share of second town $=£\frac{3000\times530}{9700}=£163.\ 18s.\ 4\frac{20}{97}d.;$

$$\text{share of third town} = £\frac{4200 \times 530}{9700} = £229.\ 9s.\ 8\tfrac{28}{97}d.$$

$$\text{Also, share of each person} = £\frac{530}{9700} = 1s.\ 1\tfrac{11}{97}d.$$

7. $$15 \text{ men} = 40 \text{ boys}, \therefore 1 \text{ man} = \frac{40}{15} \text{ boys} = \frac{8}{3} \text{ boys};$$

$$\therefore 10 \text{ men} + 20 \text{ boys} = \left(\frac{80}{3} + 20\right) \text{boys} = \frac{140}{3} \text{ boys}.$$

$$\text{Then} \quad \left.\begin{matrix} \frac{140}{3} : 40 \\ 1 : 7 \end{matrix}\right\} :: 12 : \text{number of days required};$$

$$\therefore \text{number of days} = \frac{40 \times 7 \times 12}{\frac{140}{3}} = \frac{40 \times 7 \times 12 \times 3}{140} = 72.$$

8. $$\text{Interest} = \frac{(£64.\ 10s.) \times 4\tfrac{1}{2} \times \frac{2}{3}}{100} = \frac{£193.\ 10s.}{100} = £1.\ 18s.\ 8\tfrac{1}{4}d.\ {\cdot}6q.,$$

$$\text{and, since interest on } £100 \text{ for 8 months} = \frac{2}{3} \text{ of } £4.\ 10s. = £3,$$

$$103 : 64\tfrac{1}{2} :: £3 : \text{discount required};$$

$$\therefore \text{Discount} = £\frac{64\tfrac{1}{2} \times 3}{103} = £\frac{387}{206} = £1.\ 17s.\ 6\tfrac{3}{4}d.\ {\cdot}5q. \text{ nearly};$$

$$\therefore \text{Difference} = £1.\ 18s.\ 8\tfrac{1}{4}d.\ {\cdot}6q. - £1.\ 17s.\ 6\tfrac{3}{4}d.\ {\cdot}5q. = 1s.\ 1\tfrac{1}{2}d. \text{ nearly}.$$

9. There are 80 square yards in the room, (since £4 = 80s.),

$$\text{and in the floor } \frac{112}{\frac{9}{2}} \text{ sq. yds., or } \frac{224}{9} \text{ sq. yds., or 224 sq. feet};$$

$$\therefore \text{length} = \frac{224}{14} \text{ ft.} = 16 \text{ ft.},$$

$$\text{and } 2 \text{ height } \{16 + 14\} = (80 \times 9) \text{ sq. ft.};$$

$$\therefore \text{height} = \frac{80 \times 9}{2 \times 30} \text{ ft.} = 12 \text{ ft.}$$

10. He gives £(100 × 200), or £20,000.

He realizes £(46 × 200), or £9200.

Then 92 : 9200 :: £3 : his income in consols;

$$\therefore \text{income in consols} = £\frac{9200 \times 3}{92} = £300.$$

Also, income in railway shares was £(200×2), or £400;

$\therefore$ he loses £100 in his income.

11. £$1170\div 2=$ £585 to be paid in each kind of corn;

$\therefore \dfrac{585\times 20}{48}=$ number of quarters of wheat to be paid,

$\dfrac{585\times 20}{30}=$ .... barley ....;

$$\therefore \text{new rent}=\left(\frac{585\times 20\times 56}{48}+\frac{585\times 20\times 32}{30}\right)s.$$

$$=585\times\left(\frac{70}{6}+\frac{64}{3}\right)s.$$

$$=\frac{585\times 134}{3}s.=\text{£}1306.\ 10s.$$

12. Let £$x=$ value of rent charge,

£$\dfrac{7x}{10}=$ amount on which rates are calculated;

$$\therefore \text{£}\left(\frac{7x}{10}\times\frac{3}{20}\right)=\text{amount of rates};$$

$$\therefore x+\frac{21x}{200}=\text{£}884;$$

$$\therefore \frac{221x}{200}=\text{£}884;$$

$$\therefore \frac{x}{200}=\text{£}4;$$

$$x=\text{£}800;$$

$$\therefore \text{rateable value}=\text{£}\frac{7x}{10}=\text{£}560.$$

III.

1. $\dfrac{13}{15}$ is greater than $\dfrac{6}{7}$:

if $\dfrac{13\times 7}{15\times 7}$ be greater than $\dfrac{6\times 15}{15\times 7}$

or $\dfrac{91}{105}$ greater than $\dfrac{90}{105}$, $\therefore \dfrac{13}{15}$ is greater than $\dfrac{6}{7}$.

Again, $\dfrac{13}{15}$ is less than $\dfrac{7}{8}$:

if $\dfrac{13\times 8}{15\times 8}$ be less than $\dfrac{15\times 7}{8\times 15}$

$$\text{or } \frac{104}{120} \text{ less than } \frac{105}{120}, \quad \therefore \frac{13}{15} \text{ is less than } \frac{7}{8}.$$

$$\text{Also, } \frac{1\frac{1}{4}-\frac{5}{12}}{1\frac{1}{4}+\frac{5}{12}}+\frac{7}{6} \text{ of } \frac{9\times5}{14\times3}-\frac{11\frac{1}{4}}{15}$$

$$=\frac{\frac{5}{4}-\frac{5}{12}}{\frac{5}{4}+\frac{5}{12}}+\frac{7\times5}{2\times14}-\frac{45}{60}$$

$$=\frac{\frac{10}{12}}{\frac{20}{12}}+\frac{5}{4}-\frac{3}{4}=\frac{10}{20}+\frac{5}{4}-\frac{3}{4}=1.$$

2. (*α*) $$£\left(\frac{1}{2}+\frac{3}{4}\right)+\left(\frac{1}{3}+\frac{3}{5}\right)s.+\left(\frac{1}{4}+\frac{4}{5}\right)d.$$

$$=£\frac{5}{4}+\frac{14}{15}s.+\frac{21}{20}d.$$

$$=\left(\frac{5\times20\times12}{4}+\frac{14+12}{15}+\frac{21}{20}\right)d.=\left(300+\frac{56}{5}+\frac{21}{20}\right)d.$$

$$=\frac{6000+224+21}{20}d.;$$

$$\therefore \text{decimal required}=\frac{6245}{20\times12\times20}=\frac{62\cdot45}{48}=1\cdot301041\dot{6}.$$

(*β*) Since 25 francs = 20*s.*,

$$1 \text{ franc }=\frac{20}{25}s.,$$

$$60 \text{ francs}=\frac{20\times60}{25}s.;$$

$$\therefore \text{decimal required}=\frac{20\times60}{25\times21}=\frac{48}{21}=\frac{16}{7}=2\cdot\dot{2}8571\dot{4}.$$

3. If 30 men do a certain amount of work in 48 days, how many will do the same amount in (60—48) days, *i. e.* in 12 days?

12 : 48 :: 30 : number of men required;

$$\therefore \text{number required}=\frac{48\times30}{12}=120;$$

∴ 90 additional men will be needed.

4. $$\text{Cost}=£\left(381\div 4\tfrac{1}{2}\times 1\tfrac{1}{2}\times 60\times\frac{3{\cdot}75}{105}\times\frac{1}{25{\cdot}4}\right)$$
$$=£\frac{381\times 2\times 3\times 60\times 3{\cdot}75}{9\times 2\times 105\times 25{\cdot}4}$$
$$=£\frac{127\times 60\times 375}{105\times 2540}=£\frac{6\times 375}{105\times 2}=£\frac{375}{35}=£\frac{75}{7}=£10.\ 14s.\ 3\tfrac{3}{7}d.$$

5. In one hour A, B and C can do $\frac{1}{12}+\frac{1}{4}+\frac{1}{3}$, or $\frac{8}{12}$, or $\frac{2}{3}$;

$\therefore$ in half an hour they can do $\frac{1}{3}$;

$\therefore$ $\frac{2}{3}$ remain to be done.

In one hour B and C can do $\frac{1}{4}+\frac{1}{3}$, or $\frac{7}{12}$;

$\therefore$ $\frac{7}{12}:\frac{2}{3}$ :: 1 hr. : time required;

$\therefore$ time required $=\frac{2}{3}\times\frac{12}{7}=\frac{8}{7}=1\frac{1}{7}$ hrs.

6. $\frac{86{\cdot}64}{6}=14{\cdot}44$ sq. feet in each of the 6 sides of the cube.

Then $\sqrt{14{\cdot}44}=3{\cdot}8$ ft., the length of an edge of the cube.

Again, $$(101293)^2=(101290+3)^2$$
$$=(101290)^2+2\times 3\times 101290+3^2$$
$$=10259664100+607740+9$$
$$=10260271849.$$

Also $$10582009=10562500+19500+9$$
$$=(3250)^2+6\times 3250+(3)^2;$$

$\therefore$ sq. root of $10582009=3250+3$
$$=3253.$$

7. 102 : 30192 :: £100 : present worth of £30192;

$\therefore$ present worth $=£\frac{30192\times 100}{102}=£29600.$

He receives £1. 10*s.*—2*s.*, or £1. 8*s.*, for his half-yearly dividend on £100 stock.

Then $92\frac{1}{2}$: 29600 :: £$1\frac{2}{5}$: his income;

$\therefore$ income $=£\frac{29600\times 7\times 2}{185\times 5}=£448.$

8. 1 cubic ft. of marble weighs (2·716 × 1000) oz. = 2716 oz.;

$\therefore 1 : 9\frac{1}{2} \times 2\frac{1}{4} \times 2 :: 2716$ oz. : wt. of the block in oz.;

$$\therefore \text{wt. of block} = \left(\frac{19}{2} \times \frac{9}{4} \times 2 \times 2716\right) \text{oz.}$$

$$= (171 \times 679)\,\text{oz.} = 116109\,\text{oz.} = 3 \text{ tons } 4 \text{ cwt. } 3 \text{ qrs. } 4 \text{ lbs. } 13 \text{ oz.}$$

9. Let x = book debts;

$x - 6000$ = amount paid in full;

4000 = amount on which 13*s.* 4*d.* in the pound is recovered;

$\frac{x}{20}$ = expenses of the bankruptcy.

$$\text{Then } x - 6000 + 4000 - \frac{x}{20} = \frac{13x}{20};$$

$$\therefore 20x - 40000 - x = 13x;$$

$$\therefore 20x - x - 13x = 40000;$$

$$\therefore 6x = 40000;$$

$$\therefore x = £6666.\ 13s.\ 4d.$$

10. He is to get 70 per cent. of the price;

$\therefore 70 : 100 :: 14s.$: price of book;

$$\therefore \text{price of book} = \frac{100 \times 14}{70}\,s. = 20s. = £1.$$

11. He gets £115 for what cost £100, by means of false scales, and then he sells at a profit of 15 per cent.;

$\therefore 100 : 115 :: £115$: what he finally sells that, which cost £100, for;

$$\therefore \text{he sells for } £\frac{115 \times 115}{100} = £132{\cdot}25;$$

$\therefore$ 32·25 will be his whole gain per cent.

12. Suppose I invest £100 sterling in each investment;

then $87 : 100 :: £2.\ 16s.$: interest on £100 in first investment;

$$\therefore \text{first gives } £\frac{100 \times 2\frac{4}{5}}{87} = £\frac{280}{87} = £3.\ 4\tfrac{32}{87}s.,$$

and $230 : 100 :: £7\frac{1}{2}$: interest on £100 in second investment;

$$\therefore \text{second gives } £\frac{100 \times 7\frac{1}{2}}{230} = £\frac{75}{23} = £3.\ 5\tfrac{5}{23}s.;$$

$\therefore$ the second is the better investment.

IV. (p. 287.)

1. 12*s*. 6*d*. × 40 = £25,

15*s*. 6*d*. × 60 = £46. 10*s*.;

$$\therefore \text{average price} = \frac{\pounds 25 + \pounds 46.\ 10s.}{40+60} = \frac{\pounds 71.\ 10s.}{100} = 14s.\ 3\tfrac{1}{2}d.\ \tfrac{2}{5}q.$$

Also 15*s*. × 100 = £75, the price for which the whole is sold;

∴ profit = £75 — £71. 10*s*. = £3. 10*s*.

2. (*a*) Amount of dividends = £(·25 + ·118 + ·209) = £·577;

∴ loss in the pound = £(1 — ·577) = £·423;

∴ loss sustained by creditors = £(4265 × ·423) = £1804·095

= £1804. 0 f. 9 c. 5 m.

(*β*) Since 21*s*. = 27 fr.,

$$\pounds 1 = \left(\frac{20}{21} \text{ of } 27\right) \text{fr.} = \frac{20 \times 9}{7} \text{ fr.}$$

Now £2843 × 25 = 71075 francs;

∴ 71075 + 7·5 = 71082·5 francs, the sum transmitted in first case.

$$\text{Hence } 71082{\cdot}5 \times \pounds\frac{7}{20 \times 9} = \text{amount to be remitted in second case;}$$

$$\therefore \text{amount} = \pounds\frac{710825 \times 7}{10 \times 20 \times 9} = \pounds\frac{4975775}{1800} = \pounds 2764\,\frac{575}{1800},$$

$$\text{and } \pounds\frac{575}{1800} = \frac{575}{1800} \times \frac{20 \times 9}{7} \text{ fr.} = \frac{575}{70} \text{ fr.} = 8{\cdot}2\dot{1}4285\dot{7} \text{ fr.};$$

$$\therefore \text{sum required} = \pounds 2764.\ 8 \text{ fr. } 2{\cdot}\dot{1}4285\dot{7} \text{ c.}$$

3. Since the men work on an average 9 hours a day in the second case, we may leave this out of the question.

$$\text{Then} \quad \left.\begin{array}{rcl} 4 & : & 3 \\ 315 & : & 1575 \\ 30 & : & 35\frac{1}{2} \end{array}\right\} :: 16 : \text{number of days required;}$$

$$\therefore \text{number of days} = \frac{3 \times 1575 \times \frac{71}{2} \times 16}{4 \times 315 \times 30} = \frac{3 \times 5 \times 71 \times 8}{4 \times 30} = 71.$$

4. $\sqrt[3]{5359{\cdot}375} = 17{\cdot}5$ ft.,

$\sqrt[3]{5{\cdot}359375} = 1{\cdot}75$ ft.;

∴ difference = (17·5 — 1·75) ft. = 15·75 ft. = 189 inches.

5. Let x = price of a first class ticket.

Then he paid $2x + \frac{2x}{3} + \frac{x}{2}$, or $\frac{19x}{6}$;

$$\therefore \frac{19x}{6} = £1.\ 11s.\ 8d., \text{ or } 19x = £9.\ 10s.;$$

$$\therefore x = 10s. \text{ and } \frac{2x}{3} = 6s.\ 8d.,$$

$$\text{and rate per mile} = \frac{10}{60}s. = 2d.$$

6. $191\frac{5}{8} : 31\frac{1}{2} :: 365$: number of days required;

$$\therefore \text{number of days} = \frac{365 \times 63 \times 8}{1533 \times 2} = \frac{365 \times 9 \times 4}{219} = \frac{365 \times 3 \times 4}{73} = 60.$$

7. $5 : 15 :: £105$: sum required;

$$\therefore \text{sum required} = £\frac{105 \times 15}{5} = £315.$$

8.
$$\left.\begin{array}{l} 8 : 1 \\ 8 : 3\frac{1}{2} \\ 3 : \frac{1}{2} \end{array}\right\} :: 100 : \text{cost in nishcas};$$

$$\begin{aligned} \therefore \text{cost in nishcas} &= \frac{100 \times 3\frac{1}{2} \times \frac{1}{2}}{8 \times 8 \times 3} = \frac{700}{4 \times 8 \times 8 \times 3} \text{ nishcas} \\ &= \frac{700 \times 16}{4 \times 8 \times 8 \times 3} \text{ drammas.} \\ &= 14\tfrac{7}{12} \text{ dr.} \\ &= 14 \text{ dr. } 9 \text{ pan. } 1 \text{ cac. } 6\tfrac{2}{3} \text{ cow. sh.} \end{aligned}$$

9.
$$\begin{array}{r|rrrl} & £ & s. & d. & \\ 2 \text{ qrs.} = \frac{1}{2} & 0\ . & 17\ . & 11\frac{1}{2} & = \text{value of 1 cwt.} \\ & & & 11 & \\ \hline & 9\ . & 17\ . & 6\frac{1}{2} & = \text{value of 11 cwt.} \\ 1 \text{ qr.} = \frac{1}{2} & & 8\ . & 11\frac{3}{4} & = \text{value of 2 qrs.} \\ 2 \text{ lbs.} = \frac{1}{14} & & 4\ . & 5\frac{7}{8} & = \text{value of 1 qr.} \\ & & & 3\frac{95}{112} & = \text{value of 2 lbs.} \\ \hline & £10\ . & 11\ . & 3\frac{109}{112} & = \text{value of 11 cwt. 3 qrs. 2 lbs.} \\ & & & 10 & \\ \hline & 105\ . & 13\ . & 3\frac{41}{56} & = \text{value of 10 casks.} \\ & & & 5 & \\ \hline & 528\ . & 6\ . & 6\frac{37}{56} & = \text{value of 50 casks.} \\ & & & 2\frac{1}{4} & \\ \hline & 1056\ . & 13\ . & 1\frac{9}{28} & \\ & 132\ . & 1\ . & 7\frac{149}{224} & \\ \hline & £1188\ . & 14\ . & 8\frac{221}{224} & \\ & 20 & & & \\ \hline & 17{\cdot}74s. & & & \\ & 12 & & & \\ \hline & 8.96d. & & & \end{array}$$

$$\therefore \text{interest} = £11.\ 17s.\ 8\frac{96+\frac{221}{224}}{100}d. = £11.\ 17s.\ 8\tfrac{21725}{22400}d.;$$

$$\therefore \text{he must sell them for } £528.\ 6s.\ 6\tfrac{37}{56}d. + £11.\ 17s.\ 8\tfrac{21725}{22400}d. = £540.\ 4s.\ 3\tfrac{1}{2}d.\ \tfrac{217}{224}q.$$

10. Let x = number of quarters of wheat paid,

$$\text{fixed sum} + 56x = 250 \times 20s.,$$

$$\text{fixed sum} + 60x = 260 \times 20s.;$$

$$\therefore, \text{ subtracting, } 4x = 10 \times 20;$$

$$\therefore x = 50;$$

Then fixed sum $= (5000 - 56 \times 50)s. = (5000 - 2800)s. = 2200s.$

Hence, rent when wheat is 80*s.* a quarter, will be

$(2200 + 80 \times 50)s.$, or $(2200 + 4000)s.$, or $6200s.$, or £310.

11. A and B do $\frac{1}{10}$ daily,

B and C do $\frac{1}{15}$ ......

A and C do $\frac{1}{25}$ ......

$$\therefore 2A \text{ and } 2B \text{ and } 2C \text{ do } \frac{1}{10} + \frac{1}{15} + \frac{1}{25}, \text{ or } \frac{31}{150} \text{ daily};$$

$$\therefore A, B \text{ and } C \text{ do } \frac{31}{300} \text{ daily};$$

$$\therefore \text{in 4 days they will do } \frac{31}{75};$$

$$\therefore \text{remaining work will be } \frac{44}{75}.$$

Then in 5 days B and C will do $\frac{5}{15}$;

$$\therefore \frac{44}{75} - \frac{5}{15}, \text{ or } \frac{19}{75} \text{ remains for } C \text{ to do.}$$

Then since C does $\frac{31}{300} - \frac{1}{10}$, or $\frac{1}{300}$ daily,

$$\frac{1}{300} : \frac{19}{75} :: 1 : \text{number of days } C \text{ will take};$$

$$\therefore C \text{ takes } \frac{19 \times 300}{75}, \text{ or } 76 \text{ days.}$$

12. Area to be filled $=(91\times 32\times 5)$ ft.,

area of bale $=(3\frac{1}{2}\times 2\frac{2}{3}\times 2\frac{1}{2})$ ft.;

$$\therefore \text{ number of bales}=\frac{91\times 32\times 5\times 2\times 3\times 2}{7\times 8\times 5}=13\times 4\times 12=624.$$

V. (p. 288.)

1. (α) $(39\cdot37\times 3600)$ inches $=141732$ inches $=3937$ yards.

(β) 10 miles $=\left(\frac{3}{2}\times 10\right)$ versts $=15$ versts;

$\therefore$ 15 : 2500 :: 1 : number of hours required;

$$\therefore \text{ number of hours}=\frac{2500}{15}=166 \text{ hrs. } 40 \text{ min.}$$

2.
$$\frac{3}{5}=\cdot6$$
$$\frac{30}{57}=\frac{10}{19}=\cdot5263157894$$
$$\frac{600}{576}=\frac{25}{24}=\underline{1\cdot0416666666}$$
$$2\cdot1679824560$$

Then
$$\frac{2\cdot1679824560}{\cdot00003741}=57951\cdot95.$$

3. $(80-28)$ oz. $=52$ oz., the weight of the dessert spoons;

$$\therefore \text{ weight of each}=\frac{52}{24}\text{ oz.}=2\frac{1}{6}\text{ oz.}$$

Also $1:\frac{13}{6}\times 20\times 24::\frac{3}{16}d.:$ value of each spoon;

$$\therefore \text{ value}=\frac{13\times 20\times 24\times 3}{6\times 16}d.=195d.=16s.\ 3d.$$

4.
$$\frac{3}{4}\text{ of }\frac{5}{9}\text{ of }45s.=\frac{75}{4}s.=18s.\ 9d.;$$
$$\frac{2}{7}\text{ of 3 guineas}=\frac{2\times 3\times 21}{7}s.=18s.;$$
$$\cdot\dot{2}\dot{7}\text{ of £1. }18s.\ 6d.=\frac{27}{99}\text{ of }38\frac{1}{2}s.=\frac{27\times 77}{99\times 2}=\frac{21}{2}s.=10s.\ 6d.;$$
$$2\cdot1\dot{5}\dot{4}\text{ of }55s.=2\frac{154-1}{990}\text{ of }55s.=2\frac{17}{110}\text{ of }55s.=\frac{237}{2}s.=\text{£5. }18s.\ 6d.;$$

$$\therefore \text{ sum} = 18s.\ 9d. + 18s. + 10s.\ 6d. + £5.\ 18s.\ 6d. = £8.\ 5s.\ 9d.;$$

$$\text{and decimal} = \frac{£8.\ 5s.\ 9d.}{25 \text{ guineas}} = \frac{1989}{25 \times 21 \times 12} = \frac{221}{700} = \frac{2{\cdot}21}{7} = {\cdot}31\dot{5}7142\dot{8}.$$

5. In a year he may spend $£\left(840{\cdot}5 - 63{\cdot}966\tfrac{2}{3} - \frac{16}{240} \text{ of } 840{\cdot}5\right)$,

$$= £\left(\frac{224}{240} \text{ of } 840{\cdot}5 - 63{\cdot}9\dot{6}\right),$$

$$= £\left(\frac{14}{15} \text{ of } \frac{8405}{10} - 63\frac{96-9}{90}\right),$$

$$= £\left(\frac{14}{3} \text{ of } \frac{1681}{10} - 63\frac{87}{90}\right),$$

$$= £\left(\frac{23534}{30} - \frac{1919}{30}\right),$$

$$= £\frac{21615}{30};$$

$$\therefore \text{ in a day he may spend } £\frac{21615}{30 \times 365} = £\frac{1441}{730} = £1{\cdot}973972$$

$$= £1.\ 9\text{ f. } 7\text{ c. } 3{\cdot}972\text{ m.}$$

6.
$$\sqrt{\frac{1000{\cdot}10001}{1000}} = \sqrt{1{\cdot}00010001} = 1{\cdot}000049\ldots$$

$$\sqrt[3]{{\cdot}03} = \sqrt[3]{{\cdot}03\dot{0}00\dot{0}00\dot{0}00\dot{0}} = {\cdot}3107\ldots\ldots$$

7. In 45 days 35 men do the piece of work;

$\therefore$ in 15 days 35 men do $\frac{1}{3}$ of the work;

$\therefore \frac{2}{3}$ remains to be done.

Then in the next 15 days there are 28 men at work;

$\therefore 35 : 28 :: \frac{1}{3}$: amount they do;

$\therefore$ amount $= \frac{4}{5}$ of $\frac{1}{3} = \frac{4}{15}$;

$\therefore \frac{2}{3} - \frac{4}{15}$, or $\frac{2}{5}$ remains to be done.

Then 21 men work, who do $\frac{3}{4}$ of that which 28 men do, in next 15 days;

$\therefore \frac{2}{5} - \frac{3}{4}$ of $\frac{4}{15}$, or $\frac{1}{5}$ remains to be done.

Then 14 men work, who do $\frac{2}{3}$ of that which 21 men do, in next 15 days;

$$\therefore \frac{1}{5}-\frac{2}{3} \text{ of } \frac{1}{5}, \text{ or } \frac{1}{15} \text{ remains to be done.}$$

Then 7 men work, who do $\frac{1}{2}$ of that which 14 men do, in next 15 days;

$$\therefore \text{ they do } \frac{1}{2} \text{ of } \frac{2}{15}, \text{ or } \frac{1}{15};$$

$\therefore$ they finish the work;

and $15+15+15+15+15=75$ days.

8. Let $x = A$'s share,

$$\frac{5x}{6} = B\text{'s share},$$

$$\frac{3 \times 5x}{2 \times 6} = C\text{'s share},$$

$$\frac{3 \times 3 \times 5x}{4 \times 2 \times 6} = D\text{'s share};$$

$$\therefore x+\frac{5x}{6}+\frac{5x}{4}+\frac{15x}{16} = £16984;$$

$$\therefore 386x = (£16984 \times 96), \quad \therefore x = £4224.$$

Then A's share $= £4224$, B's $= £3520$, C's $= £5280$, D's $= £3960$.

9. Area of walls $= 2 \times 15\,\{30+15\}$ sq. ft.

$= (30 \times 45)$ sq. ft. $= (30 \times 5)$ sq. yds.;

$$\therefore \text{ number of yards of paper required} = \frac{30 \times 5}{1\frac{1}{2}} = 100;$$

$\therefore$ cost $= (100 \times 4\frac{1}{2})d. = 450d. = £1.\ 17s.\ 6d.$

In the second case

Area of walls $= 2 \times 30\,(60+30)$ sq. ft.

$= (60 \times 90)$ sq. ft. $= 600$ square yards;

$$\therefore \text{ number of yards of paper required} = \frac{600}{3};$$

$$\therefore \text{ cost} = \frac{600 \times 9}{3}\,d. = 1800d. = £7.\ 10s.$$

10. Let x = produce in quarters.

$$\text{Then } \frac{75x}{100} + 10000000 = \frac{95x}{100};$$

$$\therefore 10000000 = \frac{20x}{100};$$

$\therefore 50000000 = x$, the number of quarters required.

11. Length of cloister = length of court + 2 breadth of cloister

$$= (137{\cdot}31 + 24{\cdot}9)\text{ ft.} = 162{\cdot}21\text{ ft.}$$

Breadth of cloister = breadth of court = 125·79 ft.;

$$\therefore \text{area to be paved} = 2 \times 12{\cdot}45\,(162{\cdot}21 + 125{\cdot}79)\text{ sq. ft.}$$
$$= (24{\cdot}9 \times 288)\text{ sq. ft.};$$

$$\therefore \text{number of stones} = \frac{24{\cdot}9 \times 288}{5{\cdot}76 \times 4{\cdot}15} = \frac{249 \times 288 \times 1000}{576 \times 415} = 300\text{ stones.}$$

12. (α) Income in first case would have been $£\frac{1000 \times 3}{86} = £\frac{1500}{43} = £34\frac{38}{43}$,

Income in second case is $£\frac{1000 \times 3}{87} = £\frac{3000}{87} = £34\frac{42}{87}$;

$$\therefore \text{difference} = £\left(\frac{38}{43} - \frac{42}{87}\right) = £\frac{1500}{3741} = 8\tfrac{24}{1247}s.$$

(β) When money is worth 4 per cent., the 3 per cent. consols should be at $\frac{100 \times 3}{4}$, or 75,

When money is worth 5 per cent., the 3 per cent. consols should be at $\frac{100 \times 3}{5}$, or 60;

$\therefore$ they should fall from 75 to 60.

VI. (p. 289.)

2. 18 boys = 12 men, ∴ 9 boys = 6 men, ∴ 11 men + 9 boys = 17 men.

Then $\left.\begin{matrix} 17 : 12 \\ \frac{3}{4} : \frac{1}{4} \end{matrix}\right\} :: 6\frac{1}{2}$: time required;

$$\therefore \text{number of hours} = \frac{12 \times \frac{1}{4} \times \frac{13}{2}}{17 \times \frac{3}{4}} = \frac{12 \times 13}{17 \times 3 \times 2} = \frac{26}{17} = 1\tfrac{9}{17}.$$

3. 20*s.* : 16*s.* 6*d.* :: 6 th. 20 gr. : number of thalers for which a Napoleon may be obtained;

$$\therefore \text{a Napoleon costs } \frac{(6\text{ th. }20\text{ gr.}) \times 16\frac{1}{2}}{20} = \frac{6\frac{2}{3} \times 16\frac{1}{2}}{20}\text{ th.} = \frac{11}{2}\text{ th.} = 5\text{th. }15\text{gr.};$$

$\therefore$ gain = 5 th. 17½ gr. — 5 th. 15 gr. = 2½ groschen.

4. Let x = gross rental,

$$\frac{7x}{240} = \text{income tax};$$

$$\frac{5}{100}\left(x - \frac{7x}{240}\right) = \text{deduction to be made for collecting.}$$

Then
$$x - \frac{7x}{240} - \frac{5}{100} \cdot \frac{233x}{240} = £959.\ 3s.\ 8d.;$$

$$\therefore \frac{233x}{240} - \frac{1}{20} \cdot \frac{233x}{240} = 959\tfrac{11}{60};$$

$$\therefore \frac{19}{20} \cdot \frac{233x}{240} = 959\tfrac{11}{60};$$

$$\therefore \frac{19}{20} \cdot \frac{233x}{240} = \frac{57551}{60};$$

$$\therefore x = \frac{57551 \times 20 \times 240}{19 \times 233 \times 60} = £1040.$$

5. Present worth = £226. 2s. 8d. − £12. 16s. = £213. 6s. 8d.

Again, discount for 1 year $= \frac{2}{3}$ of £12. 16s. $= \frac{2}{3}$ of £$12\frac{4}{5}$ = £ $\frac{2 \times 64}{3 \times 5}$;

and, since Discount is the interest on the Present Worth,

$$213\tfrac{1}{3} : 100 :: \frac{2 \times 64}{3 \times 5} : \text{rate of interest};$$

$$\therefore \text{rate} = \frac{2 \times 64 \times 100 \times 3}{640 \times 3 \times 5} = \frac{10 \times 2}{5} = 4 \text{ per cent.}$$

6. His stock is clearly £10000.

For half of this he gets £(5000 × 92) = £4600.

He buys with this $\frac{4600}{23} = 200$ shares,

and from this his income is to be £200;

∴ every £50 share must give him £1;

∴ the dividend per cent. must be £2.

7. Number of grains required $= \frac{25000 \times 1760 \times 3}{550} = 5000 \times 16 \times 3$;

$$\therefore \text{number of oz.} = \frac{5000 \times 16 \times 3}{24 \times 20} = 500;$$

∴ cost = £(500 × $4\frac{1}{4}$) = £(125 × 17) = £2125.

8. (α) Since $B=\dfrac{C}{2\frac{1}{6}}$,

$$A=\frac{7}{6}\text{ of }\frac{C}{2\frac{1}{6}}=\frac{\frac{7}{6}}{\frac{13}{6}}\text{ of }C=\frac{7}{13}\text{ of }C.$$

(β) $$\frac{\frac{3}{5}}{\frac{8}{9}}+\frac{\frac{5}{7}}{7\frac{1}{2}\text{ of }\frac{11}{12}}+\left(\frac{3\frac{3}{4}}{4\frac{2}{7}}-\frac{3\frac{2}{5}}{4\frac{1}{4}}+\frac{\frac{4}{7}}{2\frac{1}{2}}\right)\div 4\frac{6}{7}$$

$$=\frac{27}{40}+\frac{8}{77}+\left(\frac{7}{8}-\frac{4}{5}+\frac{8}{35}\right)\div\frac{34}{7}$$

$$=\frac{27}{40}+\frac{8}{77}+\frac{17}{56}\div\frac{34}{7}$$

$$=\frac{27}{40}+\frac{8}{77}+\frac{1}{16}=\frac{5183}{6160}.$$

(γ)
$$\begin{array}{r} 51{\cdot}6\,)\,10{\cdot}836\,(\,{\cdot}21 \\ \underline{1032}\phantom{(\,{\cdot}21} \\ 516\phantom{(\,{\cdot}21} \\ \underline{516}\phantom{(\,{\cdot}21} \end{array}$$

$$\therefore\ \frac{1083{\cdot}60}{5{\cdot}16}=210,$$

and $$\frac{1083{\cdot}60000}{{\cdot}00516}=210000.$$

9. Value of 56 lbs. of tea at 4*s*. 2*d*. = 4*s*. 2*d*. × 56 = £11. 13*s*. 4*d*.

Then if x = number of pounds of the other sort, and since he is to sell for $\frac{1}{5}$ more than cost price,

$$£11.\ 13s.\ 4d.+x\times(2s.\ 11d.)+\frac{1}{5}\{£11.\ 13s.\ 4d.+x\times(2s.\ 11d.)\}$$
$$=(56+x)\times(3s.\ 8d.)$$

$$2800+35x+\frac{1}{5}\{2800+35x\}=56\times 44+44x,$$

$$2800+35x+560+7x=2464+44x;$$

$$\therefore\ 3360-2464=44x-42x;$$

$$\therefore\ 896=2x,\ \therefore\ x=448\text{ lbs.}$$

10. 1 square mile = (1760 × 1760) sq. yds. $=\dfrac{1760\times 1760}{4840}$ sq. acres;

$\therefore$ 1 sq. in. : 4 sq. ft. 4 sq. in. :: $\dfrac{1760\times 1760}{4840}$: number of acres represented;

$$\therefore\ \text{number of acres}=\frac{1760\times 1760\times 580}{4840}=4\times 160\times 580=371200.$$

11. (*a*) Income received for £100 stock = £2. 16*s*.;

$$\therefore 4 : 2\tfrac{4}{5} :: 100 : \text{price of consols};$$

$$\therefore \text{price of consols} = \frac{100 \times 14}{4 \times 5} = 70.$$

(*β*) He has £90 left out of each £100;

$$\therefore 90 : 100 :: £1250 : \text{his gross income};$$

$$\therefore \text{gross income} = £\,\frac{1250 \times 100}{90} = £1388.\ 17s.\ 9\tfrac{1}{3}d.$$

12. Let x = the whole constituency.

Then $\frac{19x}{40}$ = number who voted for the successful candidate,

and $\frac{x}{16}$ = number who did not vote;

$$\therefore x = \frac{19x}{40} + \left(\frac{19x}{40} - 5\right) + \frac{x}{16};$$

$$\therefore x = \frac{38x}{40} - 5 + \frac{x}{16};$$

$$\therefore 80x = 76x - 400 + 5x;$$

$$\therefore 80x = 81x - 400;$$

$$400 = x;$$

$\therefore$ successful candidate obtained $\frac{19 \times 400}{40} = 190$ votes,

and the unsuccessful candidate obtained 185 votes.

VII. (p. 290.)

2. 18 tons = (18 × 20 × 112 × 16) oz.;

$$\therefore \text{number of cubic feet} = \frac{18 \times 20 \times 112 \times 16}{1000} = \frac{64512}{100} = 645{\cdot}12.$$

3.

$$\left.\begin{array}{r} 3 : 20 \\ 50 : 30 \\ 12 : 10 \end{array}\right\} :: 2 : \text{number of pages required};$$

$$\therefore \text{number of pages} = \frac{20 \times 30 \times 10 \times 2}{3 \times 50 \times 12} = 6\tfrac{2}{3}.$$

4. Content of each side = (3·5 × 3·5) square feet;

$\therefore$ content of 6 sides = (6 × 3·5 × 3·5) square feet;

$$\therefore \text{cost}=\left(\frac{6\times 3\cdot 5\times 3\cdot 5}{9}\times 1\tfrac{1}{3}\right)s.=\frac{2\times 3\cdot 5\times 3\cdot 5\times 4}{9}s.$$

$$=\frac{98}{9}s.=10s.\ 10\tfrac{2}{3}d.$$

5.
$$\left.\begin{matrix}76\tfrac{2}{3} : 103\tfrac{1}{2}\\ 24 : 16\end{matrix}\right\} :: 25 : \text{number of } \textit{men} \text{ required};$$

$$\therefore \text{number of men}=\frac{207\times 16\times 25\times 3}{230\times 24\times 2}=\frac{45}{2};$$

$$\therefore \text{number of } \textit{boys} \text{ required}=\frac{45}{2}\times 2=45.$$

6.
$$\text{Prime cost}+\frac{3}{8}\text{ prime cost}=5s.\ 6d.;$$

$$\therefore \frac{11}{8}\text{ prime cost}=5s.\ 6d.;$$

$$\therefore \text{prime cost}=\frac{5s.\ 6d.\times 8}{11}=4s.;$$

∴ on 4*s.* he gains 2*s.* 6*d.*, if he sell the book for 6*s.* 6*d.*;

$$\therefore 4 : 2\tfrac{1}{2} :: 100 : \text{gain per cent.};$$

$$\therefore \text{gain per cent.}=\frac{100\times 2\tfrac{1}{2}}{4}=62\tfrac{1}{2}.$$

7. Brussels a yard wide costs $\frac{6}{5}$ of 5*s.*, or 6*s.*,

Kidderminster .... 3*s.* $4\frac{1}{2}$*d.*,

Drugget .... $\frac{3}{4}$ of 2*s.* 6*d.*, or 1*s.* $10\frac{1}{2}$*d.*;

∴ for 1 year Brussels will cost $\frac{6}{10}$ *s.* or $7\frac{1}{5}$*d.*,

.... Kidderminster... $\frac{3s.\ 4\frac{1}{2}d.}{6}$, or $6\frac{3}{4}$*d.*,

.... Drugget .... $\frac{1s.\ 10\frac{1}{2}d.}{3}$, or $7\frac{1}{2}$*d.*;

∴ Kidderminster is the cheapest, and Drugget the dearest.

8. (*a*)
$$\frac{3\tfrac{1}{2}\text{ of }1\tfrac{1}{4}}{1\tfrac{5}{6}\text{ of }3\tfrac{3}{4}}\div\frac{1\tfrac{3}{5}\text{ of }2\tfrac{1}{4}}{1\tfrac{1}{10}\text{ of }2\tfrac{1}{7}}=\frac{\frac{7}{2}\times\frac{5}{4}}{\frac{11}{6}\times\frac{15}{4}}\div\frac{\frac{8}{5}\times\frac{9}{4}}{\frac{11}{10}\times\frac{15}{7}}$$

$$=\frac{7\times 5\times 6\times 4}{2\times 4\times 11\times 15}\div\frac{8\times 9\times 10\times 7}{5\times 4\times 11\times 15}$$

$$=\frac{7\times 5\times 6\times 4\times 5\times 4\times 11\times 15}{2\times 4\times 11\times 15\times 8\times 9\times 10\times 7}=\frac{5}{12}$$

$$\left(\frac{2\frac{1}{4}-\frac{2}{3}\text{ of }1\frac{5}{6}}{\frac{1}{5}\text{ of }3\frac{1}{3}+\frac{13}{36}}-\frac{1}{2\frac{1}{2}}\right)\div\frac{1}{1\frac{2}{3}}$$

$$=\left(\frac{\frac{9}{4}-\frac{11}{9}}{\frac{2}{3}+\frac{13}{36}}-\frac{2}{5}\right)\div\frac{3}{5}=\left(\frac{81-44}{24+13}-\frac{2}{5}\right)\times\frac{5}{3}$$

$$=\left(\frac{37}{37}-\frac{2}{5}\right)\times\frac{5}{3}=\frac{3}{5}\times\frac{5}{3}=1.$$

(β)

$$\begin{array}{rl} & \quad s. \quad d. \\ \frac{1}{2}\text{ of }16s.\ 6\frac{1}{4}d. = & 8\ .\ 3\frac{1}{8} \\ \frac{1}{3}\text{ of }12s.\ 10\frac{1}{4}d. = & 4\ .\ 3\frac{5}{12} \\ \frac{1}{6}\text{ of }£2.\ 4s.\ 8\frac{3}{4}d. = & 7\ .\ 5\frac{11}{24} \\ \hline \therefore\ \text{the sum} = & £1\ .\ 0\ .\ 0 \end{array}$$

$$\left(\frac{3}{50}\text{ of }11\cdot8-\frac{5}{80}\text{ of }11\cdot02\right)\div0\cdot1=\left\{\frac{35\cdot4}{50}-\frac{55\cdot1}{80}\right\}\div0\cdot1$$

$$=\left(\frac{354}{500}-\frac{551}{800}\right)\div\frac{1}{10}=\frac{354}{50}-\frac{551}{80}=\frac{77}{400}=\cdot1925.$$

9. (α) 5 : 4 :: 100 : price of stock;

$$\therefore\ \text{price of stock}=\frac{4\times100}{5}=80.$$

(β) $100\frac{9}{4} : 690\frac{45}{240}$ :: £100 : Present Worth of the bill;

$$\therefore\ \text{Present Worth}=£\frac{690\frac{3}{16}\times100}{100\frac{9}{4}}=£\frac{11043\times100\times4}{16\times409}=£675.$$

Then 80 : 675 :: £100 : amount of stock to be sold;

$$\therefore\ \text{amount of stock}=£\frac{100\times675}{80}=£843.\ 15s.$$

10. 2 lbs. at 3*s.* 6*d.* = 7*s.*,

1 lb. at 5*s.* = 5*s.*;

∴ 3 lbs. of mixture cost him 12*s.*;

∴ 1 lb. cost him 4*s.*; and on this he gains 6*d.*

Then 4*s.* : 6*d.* :: 100 : gain per cent.;

$$\therefore\ \text{gain per cent.}=\frac{100\times6}{48}=\frac{100}{8}=12\frac{1}{2}.$$

11. Let x = the rate at which B travels;

then A goes over 18×9 miles, and then turns, and goes back $9x$ miles; and A takes $\frac{9x}{18}$ days to pass over $9x$ miles, and then he goes forward for $\left(22\frac{1}{2}-9-\frac{9x}{18}\right)$ days, and goes forward $\left(13\frac{1}{2}-\frac{9x}{18}\right)\times 18$ miles. Meantime, B has been steadily progressing $22\frac{1}{2}x$ miles;

$$\therefore 18\times 9-9x+\left(13\tfrac{1}{2}-\frac{9x}{18}\right)\times 18=22\tfrac{1}{2}x;$$

$$\therefore 162-9x+243-9x=22\tfrac{1}{2}x;$$

$$\therefore 405=40\tfrac{1}{2}x, \qquad \therefore x=10 \text{ miles.}$$

12. In one day A, B and C do $\frac{\frac{4}{5}}{24}$, or $\frac{4}{120}$, or $\frac{1}{30}$.

Also B and C do $\frac{\frac{5}{9}}{28}$, or $\frac{5}{252}$;

$$\therefore A \text{ does } \frac{1}{30}-\frac{5}{252}=\frac{102}{7560};$$

$$\therefore A \text{ does the work in } \frac{7560}{102} \text{ days} = 74\tfrac{2}{17} \text{ days,}$$

and B takes the same time.

$$\text{Also } C \text{ does } \frac{5}{252}-\frac{102}{7560}, \text{ or } \frac{2}{315};$$

$$\therefore C \text{ takes } \frac{315}{2} \text{ days} = 157\tfrac{1}{2} \text{ days.}$$

VIII. (p. 292.)

1. (a)

$$\text{fraction}=\frac{18\frac{1}{2}}{29}=\frac{37}{58};$$

$$\text{fraction}=\frac{5\frac{1}{4}}{4\frac{1}{5}}=\frac{\frac{21}{4}}{\frac{21}{5}}=\frac{5}{4};$$

$$\text{fraction}=\frac{\frac{11}{12}\text{ of }\frac{9}{2}}{115\frac{1}{2}}=\frac{11\times 9\times 2}{12\times 2\times 231}=\frac{1}{28};$$

$$\text{fraction}=\frac{\frac{1}{99}\text{ of }29799}{5\times 20\times 12}=\frac{301}{5\times 20\times 12}=\frac{301}{1200}.$$

(β) $$A=\frac{2\frac{2}{3} \text{ of } 1\frac{3}{8}}{7\frac{1}{3}} \text{ of } D=\frac{8\times 11\times 3}{3\times 8\times 22} \text{ of } D=\frac{1}{2} \text{ of } D.$$

(γ) $$2\tfrac{2}{3}B=\frac{3}{2} \text{ of } \left(A+\frac{3}{4} \text{ of } A\right),$$

$$\frac{8}{3}B=\frac{3}{2}\times\frac{7}{4}A, \quad \therefore \frac{8B}{3}=\frac{21A}{8}, \quad \therefore B=\frac{21A\times 3}{8\times 8};$$

$$\therefore 64B=63A, \quad \therefore A : B :: 64 : 63.$$

2. 19 half-crowns + 15 sixpences = £2. 7*s.* 6*d.* + 7*s.* 6*d.* = £2. 15*s.*,

∴ 66 : 62 :: 55*s.* : sum issued;

$$\therefore \text{sum issued}=\frac{62\times 55}{66}s.=\frac{310}{6}s.=£2.\ 11s.\ 8d.$$

3. He rows $1\frac{1}{2}$ miles with stream in 20′,

…………………… without stream in 30′;

∴ he could row 1 mile without stream in 20′;

∴ stream flows $\frac{1}{2}$ a mile in 20′;

∴ in 60′ the stream flows $1\frac{1}{2}$ miles.

Again, without stream he rows $1\frac{1}{2}$ miles in 30′;

but in 30′ the stream carries him back $\frac{3}{4}$ mile;

∴ he will be 30′ making this up, and so will take 60′ to row back.

4. 100 : 96 :: £$3\frac{3}{4}$: what he gave for each share;

$$\therefore \text{each share cost him } £\frac{3\frac{3}{4}\times 96}{100}=£3.\ 12s.$$

100 : 101 :: $3\frac{3}{4}$: what he got for each share;

$$\therefore \text{each share brought him } £\frac{3\frac{3}{4}\times 101}{100}=£3.\ 15s.\ 9d.;$$

∴ whole gain = {£3. 15*s.* 9*d.* — £3. 12*s.*} × 77 = 3*s.* 9*d.* × 77 = £14. 8*s.* 9*d.*

5. In one day *A* does $\frac{1}{4}$,

…………… *B* does $\frac{1}{5}$,

the boy does $\frac{1}{2}-\frac{1}{4}-\frac{1}{5}$, or $\frac{1}{20}$;

$$\therefore \frac{1}{2} : \frac{1}{4} :: 30s. : A\text{'s share};$$

$$\therefore A\text{'s share} = \frac{30 \times 2}{4}\,s. = 15s.,$$

$$\frac{1}{2} : \frac{1}{5} :: 30s. : B\text{'s share};$$

$$\therefore B\text{'s share} = \frac{30 \times 2}{5}\,s. = 12s.,$$

and the boy will have 3*s.*

6 $83\frac{1}{3} : 3\frac{1}{3} :: £999 :$ discount to be allowed;

$$\therefore \text{discount} = £\,\frac{999 \times 13 \times 4}{333} = (£3 \times 13) = £39.$$

7. Since $£\,\frac{500}{3} = £166.\ 13s.\ 4d.$, this is what he receives in each grain;

$$\therefore \text{quantity of wheat} = \frac{£166.\ 13s.\ 4d.}{6s.\ 6d.}\text{ bushels} = \frac{40000}{78}\text{ bushels} = 512\frac{32}{39}\text{ bushels},$$

$$\text{quantity of barley} = \frac{£166.\ 13s.\ 4d.}{3s.\ 9d.}\text{ bushels} = \frac{40000}{45}\text{ bushels} = 888\frac{8}{9}\text{ bushels},$$

$$\text{quantity of oats} = \frac{£166.\ 13s.\ 4d.}{2s.\ 9d.}\text{ bushels} = \frac{40000}{33}\text{ bushels} = 1212\frac{4}{33}\text{ bushels}.$$

Again, when corn rises 1*s.* a bushel,

$$\text{value of wheat} = \left(\frac{40000}{78} \times \frac{15}{2}\right)s. = £192.\ 6s.\ 1\tfrac{3}{4}d.\ \tfrac{5}{13}q.$$

$$\text{value of barley} = \left(\frac{40000}{45} \times \frac{19}{4}\right)s. = £211.\ 2s.\ 2\tfrac{1}{2}d.\ \tfrac{2}{3}q.$$

$$\text{value of oats} = \left(\frac{40000}{33} \times \frac{15}{4}\right)s. = \underline{£227.\ 5s.\ 5\tfrac{1}{4}d.\ \tfrac{9}{11}q.}$$

$$\therefore \text{whole value of living} = £630.\ 13s.\ 9\tfrac{3}{4}d.\ \tfrac{373}{429}q.$$

8. Area to be papered in square ft. $= 2 \times 15\,\{24\tfrac{7}{12} + 20\tfrac{5}{12}\}$

$$-6\tfrac{1}{2} \times 3 - 3 \times 11\tfrac{3}{4} \times 2\tfrac{5}{8}$$

$$= 30 \times 45 - \frac{39}{2} - \frac{47 \times 17}{4 \times 2}$$

$$= \frac{9845}{8}\text{ sq. ft.} = \frac{9845}{8 \times 9}\text{ sq. yds.};$$

$$\therefore \text{cost} = \frac{9845 \times 28}{8 \times 9}\,d. = \frac{68915}{18}\,d. = £15.\ 9s.\ 0\tfrac{1}{2}d.\ \tfrac{4}{9}q.$$

9. $(\cdot0009 - \cdot0000003)s. = \cdot0008997s.$

$116\cdot0435 \div 4\cdot0015 = 29.$

Since ·0064 oz. = (·0064 × 24 × 20) grains = 3·072 grains.

$$\text{Now } 3\cdot072 = \frac{3072}{1000} = \frac{384}{125}.$$

Hence 125 grains is the unit required.

10. (α)

$$\begin{array}{r|r} & 1\dot{6}\cdot0\dot{1}6\dot{0}0\dot{4}\,(4\cdot002 \\ & 16 \\ \hline 8002 & 16004 \\ & 16004 \\ \hline \end{array}$$

$$\text{Since } \cdot02\dot{7} = \frac{27-2}{900} = \frac{25}{900} = \frac{1}{36};$$

$$\therefore \sqrt{\cdot02\dot{7}} = \frac{1}{6}.$$

(β)

$$\begin{array}{rr|r} & & 51\dot{2}\cdot76\dot{8}38\dot{4}06\dot{4}\,(8\cdot004 \\ & & 512 \\ \hline 3 \times (8000)^2 = & 192000000 & 768384064 \\ 3 \times 8000 \times 4 = & 96000 & \\ 4^2 = & 16 & \\ \cline{2-2} & 192096016 & \\ & 4 & \\ \cline{2-2} & 768384064 & 768384064 \\ \hline \end{array}$$

$$\text{Since } 42\frac{7}{8} = \frac{343}{8};$$

$$\therefore \sqrt[3]{42\tfrac{7}{8}} = \frac{7}{2} = 3\tfrac{1}{2}.$$

(γ) Let x = one edge.

Then $x \times 2x \times 4x = 64$;

$\therefore 8x^3 = 64, \ \therefore x^3 = 8, \ \therefore x = 2.$

Hence 2 ft., 4 ft., 8 ft. are the lengths of the edges.

11. She admits $(3\frac{3}{4} \times 5)$ tons, or $18\frac{3}{4}$ tons an hour;

she discharges 12 tons an hour;

∴ she receives $6\frac{3}{4}$ tons every hour;

∴ number of hours in which she has 60 tons in her will be $60 \div 6\frac{3}{4}$, or $\dfrac{60 \times 4}{27}$;

∴ rate of sailing must be $40 \div \dfrac{60 \times 4}{27}$, or $\dfrac{40 \times 27}{60 \times 4} = 4\frac{1}{2}$ miles per hour.

12. C can do $\dfrac{2}{3}$ as much as A,

B can do $\dfrac{4}{5}$ as much as C;

∴ B can do $\dfrac{8}{15}$ as much as A;

$$\therefore \frac{8}{15} : 1 :: 12 : \text{number of weeks taken by } B;$$

$$\therefore \text{number of weeks} = \frac{12 \times 15}{8} = 22\tfrac{1}{2}.$$

IX. (p. 293.)

1. (α)
$$\frac{1}{8} + \frac{1}{4} = \frac{3}{8}; \quad \therefore C \text{ owns } \frac{5}{8}.$$

$$A\text{'s share} = £\frac{1800}{8} = £225,$$

$$B\text{'s share} = £\frac{1800}{4} = £450,$$

$$C\text{'s share} = £1125,$$

$$\text{and loss on ship} = £(1800 - 1080) = £720.$$

Then
$$A\text{'s loss} = £\,\frac{225 \times 720}{1800} = £90,$$

$$B\text{'s loss} = £\,\frac{450 \times 720}{1800} = £180;$$

$$\therefore C\text{'s loss} = £(720 - 90 - 180) = £450.$$

(β)
$$\text{Let } 2x = A\text{'s capital},$$

$$3x = B\text{'s capital};$$

$$\text{then } \left(2x \times 7 + \frac{2x \times 3}{4} \times 5\right) + \left(3x \times 9 + \frac{3x \times 3}{4} \times 3\right) : 2x \times 7 + \frac{2x \times 3}{4} \times 5$$

$$:: £132.\ 12s. : A\text{'s share},$$

$$\text{or } 14x + \frac{15x}{2} + 27x + \frac{27x}{4} : 14x + \frac{15x}{2} :: 2652s. : A\text{'s share},$$

$$\text{or } \frac{221x}{4} : \frac{86x}{4} :: 2652s. : A\text{'s share};$$

$$\therefore A\text{'s share} = \frac{86x \times 2652 \times 4}{221x \times 4}\,s$$

$$= 1032s. = £51.\ 12s.,$$

$$\text{and } \therefore B\text{'s share} = £132.\ 12s. - £51.\ 12s. = £81.$$

2.
$$3 \text{ lbs. at } 4s.\ 5d. = 13s.\ 3d.,$$

$$5 \text{ lbs. at } 2s.\ 10d. = 14s.\ 2d.;$$

$$\therefore 8 \text{ lbs. cost } 27s.\ 5d., \quad \therefore 2 \text{ lbs. cost } \frac{27s.\ 5d.}{4} = 6s.\ 10\tfrac{1}{4}d.$$

3. The question is, if 129 men do 28 miles in 3 months, how many men can do 161 miles in 12 months?

Then
$$\left.\begin{array}{r}28 : 161\\ 12 : 3\end{array}\right\} :: 129 : \text{number of men required};$$

$$\therefore \text{number of men} = \frac{129 \times 161 \times 3}{28 \times 12} = \frac{129 \times 23}{4 \times 4} = 185\tfrac{7}{16};$$

$$\therefore \text{he must employ 186 men.}$$

4. £46. 12*s*. 6*d*. = 11190*d*., and 1 lb. = (12 × 20 × 24) grains = 5760 grains.

Then
$$\left.\begin{array}{r}\frac{11}{12} : \frac{92{\cdot}4}{100}\\ 5760 : 179\end{array}\right\} :: 11190 : \text{value of coin in pence};$$

$$\therefore \text{value} = \frac{11190 \times 92{\cdot}4 \times 179 \times 12}{11 \times 5760 \times 100}\,d.$$

$$= \frac{1402107}{4000}\,d. = 350\tfrac{2107}{4000}d.$$

$$= £1.\ 9s.\ 2\tfrac{1}{2}d.\ \tfrac{107}{10000}q.$$

5.
$$\text{In 2 hours } A \text{ fills } \frac{2}{3};$$

$$\text{In 1 hour } B \text{ fills } \frac{1}{4};$$

$$\therefore \text{at 5 o'clock } \frac{2}{3} + \frac{1}{4}, \text{ or } \frac{11}{12} \text{ is filled.}$$

$$\text{Again, in 1 hour the part emptied} = \left(1 - \frac{1}{3} - \frac{1}{4}\right) = \frac{5}{12};$$

$$\therefore \frac{5}{12} : \frac{11}{12} :: 1\text{ hr.} : \text{time after 5 when the cistern will be emptied};$$

$$\therefore \text{time after } 5 = \frac{11}{5}\text{ hrs.} = 2\text{ hrs. } 12\text{ m.};$$

$$\therefore 12\text{ m. past 7 is time required.}$$

6.
Let x = number of parcels of each sort,
then, since 4 cwt. 3 qrs. 14 lbs. = 546 lbs.

$$6x + 8x = 546;$$

$$\therefore 14x = 546;$$

$$\therefore x = 39.$$

7. (*a*)
$$\left.\begin{array}{r}20 : 365\\ 264 : 100\end{array}\right\} :: 129d. : \text{number of pence required};$$

$$\therefore \text{number of pence} = \frac{365 \times 100 \times 129}{20 \times 264}\,d. = \frac{78475}{88}\,d.$$

$$= £3.\ 14s.\ 3\tfrac{3}{4}d.\ \tfrac{1}{22}q.$$

(β) £1157. 7*s*. $4\frac{1}{2}$*d*.—£936. 13*s*. 4*d*. = £220. 14*s*. $0\frac{1}{2}$*d*. = £$220\frac{337}{480}$.

Interest on £936. 13*s*. 4*d*. for 1 year at $4\frac{5}{6}$ per cent. $= £\,\dfrac{936\frac{2}{3}\times 4\frac{5}{6}}{100}$;

$$\therefore \frac{936\frac{2}{3}\times 4\frac{5}{6}}{100} : 220\tfrac{337}{480} :: 1 : \text{number of years required};$$

$$\therefore \text{number of years} = \frac{105937\times 3\times 6\times 100}{2810\times 29\times 480} = 4\tfrac{7}{8}.$$

(γ) £387. 7*s*. $7\frac{1}{5}$*d*.—£41. 10*s*. $1\frac{1}{5}$*d*. = £345. 17*s*. 6*d*. = £$345\frac{7}{8}$.

Also £41. 10*s*. $1\frac{1}{5}$*d*. ÷ 3 = £13. 16*s*. $8\frac{2}{5}$*d*. = £$13\frac{1002}{1200}$;

$$\therefore 345\tfrac{7}{8} : 100 :: 13\tfrac{1002}{1200} : \text{rate of interest};$$

$$\therefore \text{rate of interest} = \frac{16602\times 100\times 8}{2767\times 1200} = 4 \text{ per cent.}$$

8. 100 : 138918 :: 30·66 : the number of those who cannot read;

$$\therefore \text{number who cannot read} = \frac{138918\times 30{\cdot}66}{100} = 42592{\cdot}2588;$$

100 : 138918 :: 58·89 : the number of those who cannot read or write;

$$\therefore \text{number who cannot read or write} = \frac{138918\times 58{\cdot}89}{100} = 81808{\cdot}8102;$$

$$\therefore \text{number who cannot write} = 138918 - 124401{\cdot}069 = 14516{\cdot}931.$$

9. 1 cubic foot is 1215 lbs. in weight, or (1215 × 16) oz.;

20 sq. yards × 1 foot thick = (20 × 9 × 1215 × 16) oz.;

$$20 \text{ sq. yards} \times 1 \text{ inch thick} = \frac{20\times 9\times 1215\times 16}{12}\text{ oz.};$$

$$= 291600 \text{ oz.};$$

∴ 291600 is the number of leaves.

10. Let x = original outlay.

Then $$x+\frac{25x}{100},\text{ or }\frac{5}{4}x = \text{whole cost};$$

$$\therefore 100 : \frac{5x}{4} :: 95 : \text{sum realized};$$

$$\therefore \text{sum realized} = \frac{5x\times 95}{100\times 4} = \frac{19x}{16};$$

$$\therefore \frac{19x}{16} + 3 = \frac{5x\times 101}{4\times 100};$$

$$\therefore x = £40.$$

11. (α)
$$\left.\begin{array}{r@{\;:\;}l} 7 & 5 \\ 8 & 9 \\ 350 & 980 \\ 25 & 75 \end{array}\right\} :: 60 : \text{number of guns required;}$$

$$\therefore \text{ number of guns} = \frac{5 \times 9 \times 980 \times 75 \times 60}{7 \times 8 \times 350 \times 25} = 405.$$

(β) He pays on the average $5\frac{1}{4}d.$ in the pound;

$$\therefore £1 : 19s.\ 6\tfrac{3}{4}d. :: £1542.\ 10s.\ 6d. : \text{net income;}$$

$$\therefore \text{ net income} = \frac{(£1542.\ 10s.\ 6d.) \times 939}{960} = £1508.\ 15s.\ 7\tfrac{1}{2}d.\ \tfrac{39}{40}q.$$

12. On mortgage there is £500000,

and in shares £1500000;

Interest on mortgage = £25000,

Payment to shareholders = £90000,

∴ Money to be made = £115000;

then 55 : 100 :: £115000 : annual gross receipts;

$$\therefore \text{ annual receipts} = £\frac{115000 \times 100}{55};$$

$$\therefore \text{ weekly receipts} = £\frac{115000 \times 100}{55 \times 52};$$

$$= £4020.\ 19s.\ 6\tfrac{3}{4}d.\ \tfrac{128}{143}q.$$

X. (p. 294.)

1.
$$£1 = 25{\cdot}5 \text{ francs}$$
$$= 25{\cdot}5 \times \frac{55}{117} \text{ florins}$$
$$= 25{\cdot}5 \times \frac{55}{117} \times \frac{13}{11} \text{ marks}$$
$$= 14\tfrac{1}{6} \text{ marks.}$$

2. (α) 36 cwt. 1 qr. : 2 cwt. 2 qrs. 10 lbs. :: £69. 9s. 6d. : sum required;

$$\therefore \text{ sum} = \frac{(£69.\ 9s.\ 6d.) \times 290 \text{ lbs.}}{(145 \times 28) \text{ lbs.}} = \frac{£69.\ 9s.\ 6d.}{14} = £4.\ 19s.\ 3d.$$

(β)
$$\text{decimal} = \frac{12s.\ 0\tfrac{3}{5}d.}{10s.\ 6d.} = \frac{144\tfrac{3}{5}}{126} = \frac{723}{630} = \frac{241}{210} = 1{\cdot}1\dot{4}7619\dot{0},$$

$$\text{decimal}=\frac{12s.\ 0\tfrac{3}{5}d.}{£1}=\frac{144\tfrac{3}{5}}{240}=\frac{723}{1200}=\frac{241}{400}=\cdot6025,$$

$$\text{decimal}=\frac{12s.\ 0\tfrac{3}{5}d.}{£1000}=\frac{241}{1000\times400}=\frac{\cdot6025}{1000}=\cdot0006025,$$

$$\text{decimal}=\frac{12s.\ 0\tfrac{3}{5}d.}{£\cdot000001}=\frac{241}{400\times\cdot000001}=\frac{\cdot6025}{\cdot000001}=\frac{6025}{\cdot01}=602500.$$

(γ) $1255\div1\cdot004=1250,$

$12\cdot55\div1004=\cdot0125,$

$\cdot012550\div1004000=\cdot0000000125,$

$$\cdot12\dot{3}\times3\cdot43\dot{4}\dot{3}=\frac{123-12}{900}\times3\tfrac{43}{99}$$

$$=\frac{111}{900}\times\frac{340}{99}=\frac{629}{1485}.$$

3. (α) 90 : 1000 :: £100 : sum required;

$$\therefore\ \text{sum required}=£\frac{1000\times100}{90}=£1111.\ 2s.\ 2\tfrac{2}{3}d.$$

(β) $$\text{Interest for 1 year}=£\frac{2500\times4}{100}=£100;$$

∴ 100 : 2500 :: 1 yr. : number of years required;

$$\therefore\ \text{number of years}=\frac{2500}{100}=25.$$

(γ) $$\text{First interest}=\frac{100\times3}{82\tfrac{1}{2}};$$

$$\text{Second interest}=\frac{100\times3\tfrac{1}{2}}{93\tfrac{1}{2}};$$

$$\therefore\ \frac{\text{First interest}}{\text{Second interest}}=\frac{3\times93\tfrac{1}{2}}{82\tfrac{1}{2}\times3\tfrac{1}{2}}=\frac{3\times187\times2}{165\times7}=\frac{3\times17\times2}{15\times7}=\frac{34}{35}.$$

4. $$\left.\begin{array}{rcl}100 & : & 9760\\ 16 & : & 12\\ 8 & : & 6\\ 10 & : & \dfrac{10\times3}{4}\end{array}\right\}::64d.:\text{cost in pence};$$

$$\therefore\ \text{cost}=\frac{64\times9760\times12\times6\times10\times3}{100\times16\times8\times10\times4}d.=\frac{13176}{5}=£10.\ 19s.\ 7\tfrac{1}{5}d.$$

5.

On the 1st £500 paid at the end of	3	months the contractor would make	£35
.... 2nd	6		£30
.... 3rd	9		£25
.... 4th	12		£20
.... 5th	15		£15
.... 6th	18		£10
.... 7th	21		£5
		∴ in all he would make by interest	£140

∴ his contract amounts to 4850 + 140, or £4990.

Hence difference = (£5000 − £4990) = £10.

6. 27 : 30 :: 60′ : time it would take to go 30 miles with stoppages;

$$\therefore \text{time} = \frac{60 \times 30}{27} \text{ min.} = 66\tfrac{2}{3} \text{ min.};$$

$$\therefore \text{time lost in 30 miles, by stopping,} = 6\tfrac{2}{3} \text{ min.};$$

$$\therefore \text{time lost in 90 miles} = 3 \times 6\tfrac{2}{3} \text{ min.} = 20 \text{ min.}$$

7. In three hours 2 boys and 1 man do $\frac{3}{4}$ of work;

$$\therefore \text{2 boys and 1 man} = \frac{3}{4} \text{ of (2 men and 1 boy)};$$

$$\therefore \text{8 boys and 4 men} = \text{6 men and 3 boys};$$

$$\therefore \text{5 boys} = \text{2 men}.$$

$$\text{Then 2 boys and 1 man} = \left(\frac{4}{5} + 1\right) \text{men} = \frac{9}{5} \text{men}.$$

So if $\frac{9}{5}$ men do the work in 4 hours,

1 man will do it in $\frac{36}{5}$ or $7\frac{1}{5}$ hours.

Also 1 boy will do it in $\frac{5}{2} \times \frac{36}{5}$, or 18 hours.

Again in one hour a man and a boy do $\frac{5}{36} + \frac{1}{18}$ or $\frac{7}{36}$;

∴ they do it in $\frac{36}{7}$ or $5\frac{1}{7}$ hours.

8. $(\text{diagonal})^2 = (300)^2 + (200)^2 = 90000 + 40000 = 130000$ sq. yds.

$$\therefore \text{diagonal} = \sqrt{130000} = 360{\cdot}5 \text{ yds.}$$

Length of enclosure = 300 − (30 + 30) = 240 yds.

Breadth of enclosure = 200 − (30 + 30) = 140 yds.;

∴ area of enclosure = (240 × 140) sq.yds. = 33600 sq.yds. = 6ac. 3r. 30po. 22½sq.yds.

9. 2 cocoa-nuts = 10 pears

$= 25$ apples

$= \frac{25 \times 2}{3}$ oranges

$= \frac{25 \times 2 \times 21}{3}$ hazel-nuts

$= \frac{25 \times 2 \times 21 \times 2}{3 \times 5}$ filberts

$= 140$ filberts;

∴ he is worse off by 4 filberts.

10. 48 lbs. of coffee at $10d. = 480d.$,

12 lbs of chicory ...... $= 40d.$;

∴ 60 lbs. of the mixture cost $520d.$

∴ 1 lb. costs $\frac{520}{60}d.$, or $8\frac{2}{3}d.$;

∴ he gains on each lb. $(13 - 8\frac{2}{3})d.$, or $4\frac{1}{3}d.$

Then $8\frac{2}{3} : 4\frac{1}{3} :: 100$: gain per cent.;

∴ gain per cent. $= \frac{100 \times 4\frac{1}{3}}{8\frac{2}{3}} = \frac{100}{2} = 50.$

11. $4\frac{1}{2} : 5 :: £4500$: interest obtained by new investment;

∴ interest to be divided $= \frac{4500 \times 5 \times 2}{9} = £5000.$

Since $4 + 7 + 9 = 20$;

∴ first person's share $= \frac{4}{20}$ of £5000 = £1000,

second .... $= \frac{7}{20}$ of £5000 = £1750,

third .... $= \frac{9}{20}$ of £5000 = £2250.

12. I have passed over 9 miles when I meet the coach,

then, time coach has been on the road $= \frac{18}{10}$ hrs. = 1 hr. 48 m.;

∴ I meet the coach at 7 h. + 1 h. 48 m., or 8 h. 48 min., *i. e.* at 12 m. before 9,

and since it will take me 2 × (1 hr. 48 m.) to go 18 miles,

I reach London at 8 h. 48 m. + 3 h. 36 m., *i. e.* at 12 h. 24 m.

XI. (p. 296.)

1. The bill is due on the 25th of August, and from July 1 to August 25 there are 55 days.

$$\text{Now interest on £150 for 1 year} = £7.\ 2s.\ 6d.;$$

$$\therefore \text{ interest for 55 days} = \frac{1710 \times 55}{365}d. = \frac{1710 \times 11}{73}d. = \frac{18810}{73}d.$$

Again,

$$£150 + \text{its interest for 55 days} : £150 :: \text{interest on £150} : \text{true discount};$$

$$\therefore 36000d. + \frac{18810}{73}d. : 36000d. :: \frac{18810}{73}d. : \text{true discount};$$

$$\therefore \text{ true discount} = \frac{36000 \times 18810}{2646810}d. = \frac{2508000}{9803}d.;$$

$$\begin{aligned}\therefore \text{ banker's gain} &= \left(\frac{18810}{73} - \frac{2508000}{9803}\right)d.\\ &= \frac{184394430 - 183084000}{715619}d.\\ &= \frac{1310430}{715619}d.\\ &= 1\frac{594811}{715619}d.\end{aligned}$$

2. (a) $6\frac{3}{4}s.$ will buy $\frac{6\frac{3}{4}}{3}$ pounds of powder,

$$\text{and these contain } \left(\frac{27}{4 \times 3} \times 16 \times 16\right) \text{ drams},$$

$$\therefore \text{ number of charges} = \frac{27 \times 16 \times 16}{4 \times 3} \div 2\tfrac{1}{4} = \frac{27 \times 16 \times 16 \times 4}{4 \times 3 \times 9} = 256.$$

(β)

$$\begin{aligned}1 \text{ hectolitre} &= 22 \text{ gallons}\\ &= 11 \text{ pecks}\\ &= \frac{11}{4 \times 8} \text{ quarters};\end{aligned}$$

$$\begin{aligned}\therefore \text{ cost of a hectolitre} &= \left(\frac{11}{4 \times 8} \times \frac{42}{20} \times \frac{253}{10}\right) \text{ francs}\\ &= 18{\cdot}2634375 \text{ francs.}\end{aligned}$$

3. Content $= 2\frac{370}{999}$ cub. yds. $= \left(\frac{2368}{999} \times 27\right)$ cub. ft. $= 64$ cub. ft.;

$\therefore$ linear feet in one edge $=\sqrt[3]{64}=4$,

linear feet in a diagonal $=\sqrt{(4^2+4^2)+4^2}=\sqrt{48}=6{\cdot}928\ldots$

area of one face $=(4\times 4)$ sq. ft. $=16$ sq. ft.

4. $$\left.\begin{matrix}1000 : 1500\\ 2 : 3\end{matrix}\right\} :: 500 : \text{number of guineas required;}$$

$$\therefore \text{number of guineas}=\frac{500\times 3\times 1500}{1000\times 2}=1125.$$

5. First man's work per year $=(7\times 6\times 52)$ hrs. $=2184$ hrs.,

second man's work per year $=(6+24)\times 52$ hrs. $=1560$ hrs.;

$\therefore$ the former gains 624 hrs., or $\frac{624}{7}$ days, or $89\frac{1}{7}$ days.

6. A sells $\frac{1}{2}$ of $\frac{1}{3}$, or $\frac{1}{6}$ of the ship,

B sells $\frac{1}{3}$ of $\frac{1}{3}$, or $\frac{1}{9}$ of the ship,

C sells $\frac{1}{4}$ of $\frac{1}{3}$, or $\frac{1}{12}$ of the ship;

$\therefore$ D buys $\frac{1}{6}+\frac{1}{9}+\frac{1}{12}$, or $\frac{13}{36}$ of the ship.

Then B has $\frac{2}{9}+\frac{13}{108}$,

and C has $\frac{1}{4}+\frac{13}{108}$;

$\therefore$ B and C have $\frac{77}{108}$;

$\therefore$ A's share is $\frac{31}{108}$.

Then $\frac{77}{108}:\frac{31}{108}$ :: £7732. 1*s*. 8*d*. : value of A's share;

$\therefore$ value of A's share $=\frac{(\text{£}7732.\ 1s.\ 8d.)\times 31}{77}=$ £3112. 18*s*. 4*d*.

7. Let $x=$ the sum;

then $\frac{x\times 5}{100}=$ the interest,

and $\frac{x\times 5}{105}=$ the discount;

$$\therefore \frac{5x}{100}=1+\frac{5x}{105};$$

$$\therefore \frac{x}{20}=1+\frac{x}{21},\text{ and }\therefore x=£420.$$

8. $$\text{Number of planks}=\frac{20\frac{1}{6}\times 30}{10\times\frac{11}{12}}=\frac{121\times 30\times 12}{10\times 6\times 11}=66.$$

$$\text{Also solid content of timber}=\left(\frac{121}{6}\times 30\times\frac{2\frac{1}{2}}{12}\right)\text{ cub. ft.}$$

$$\therefore 50:\frac{121}{6}\times 30\times\frac{5}{24}::£8:\text{cost required};$$

$$\therefore \text{cost}=£\frac{121\times 30\times 5\times 8}{50\times 6\times 24}=£\frac{121}{6}=£20.\ 3s.\ 4d.$$

9. Let x = radius of the ball in inches,

$$\text{then, solid content in inches}=\frac{4}{3}\text{ of }\frac{355}{113}\text{ of }x^3;$$

$$\therefore \text{solid content in feet}=\frac{4\times 355\times x^3}{3\times 113\times 1728};$$

$$\therefore \text{weight in lbs.}=\frac{4\times 355\times x^3\times 450}{3\times 113\times 1728};$$

$$\therefore 68=\frac{4\times 355\times x^3\times 450}{3\times 113\times 1728};$$

$$\therefore x^3=\frac{68\times 3\times 113\times 1728}{4\times 355\times 450}=\frac{553248}{8875}=62{\cdot}337,$$

$$\text{then }x=\sqrt[3]{62{\cdot}337}=3{\cdot}96\text{ nearly};$$

$$\therefore \text{diameter}=2x=7{\cdot}9\text{ inches, nearly.}$$

10. He goes from A to B in $\left(\frac{2}{4}+\frac{3}{5}+\frac{7}{10}\right)$ hrs., or $\frac{18}{10}$ hrs. = 1 hr. 48 m.,

and from B to A in $\left(\frac{7}{10}+\frac{3}{4}+\frac{2}{5}\right)$ hrs., or $\frac{37}{20}$ hrs. = 1 hr. 51 m.;

$\therefore$ the difference is 3 minutes.

11. Let x = number of minutes passed over by hour-hand,

then $12x$ = ... by minute-hand;

and (1) $12x=55+x$,

$11x=55$,

$\therefore x=5$, $\therefore 12x=60$, $\therefore$ time is 12 o'clock.

(2) There are two positions in which the hands are at right angles.

(α) $12x = 55 + x - 45,$

$11x = 10,$

$x = \frac{10}{11}, \therefore$ time $= 10\frac{10}{11}$ m. past 11.

(β) $12x = 55 + x - 15,$

$11x = 40,$

$x = 3\frac{7}{11}, \therefore$ time $= 43\frac{7}{11}$ m. past 11.

(3) $12x = 55 + x - 30$

$11x = 25,$

$x = 2\frac{3}{11}, \therefore$ time $= 27\frac{3}{11}$ m. past 11.

12. I buy $\frac{1}{8}$ of $\frac{2}{9}$, or $\frac{1}{36}$.

I then have $\frac{2}{9} + \frac{1}{36}$, or $\frac{1}{4}$.

I sell $\frac{1}{13}$ of $\frac{1}{4}$, and then I have left $\frac{3}{13} = \cdot\dot{2}3076\dot{9}$,

and $\frac{3}{13}$ of £126. 14*s*. 1*d*. $= \frac{£380.\ 2s.\ 3d.}{13} = 29\cdot 23\dot{9}42307\dot{6}$.

XII. (p. 297.)

1. (α) $\left.\begin{array}{l} 10 : 5 \\ 8 : 12 \end{array}\right\} :: 600 :$ number of men required;

$\therefore$ number of men $= \frac{600 \times 5 \times 12}{10 \times 8} = 450.$

(β) $\left.\begin{array}{l} 1\frac{2}{3} : 1 \\ 1 : 2 \\ \frac{1}{3} : \frac{3}{4} \\ 1 : 2 \end{array}\right\} :: 25 :$ number of days required

$\therefore$ number of days $= \dfrac{25 \times 2 \times \frac{3}{4} \times 2}{1\frac{2}{3} \times \frac{1}{3}} = \frac{25 \times 3 \times 3 \times 3}{5} = 135.$

2. The interest for 10 years = £461. 7*s*. 2*d*. − £395. 9*s*. = £65. 18*s*. 2*d*.;

$\therefore$ interest for 20 years = £65. 18*s*. 2*d*. × 2 = £131. 16*s*. 4*d*.;

$\therefore$ sum required = £395. 9*s*. − £131. 16*s*. 4*d*. = £263. 12*s*. 8*d*.

Also, interest for 1 year = £65. 18*s*. 2*d*. ÷ 10;

$$\therefore \text{£}263.\ 12s.\ 8d. : 100 :: \frac{\text{£}65.\ 18s.\ 2d.}{10} : \text{rate of interest};$$

$$\therefore \text{rate} = \frac{\frac{15818}{10} \times 100}{63272} = \frac{15818 \times 10}{63272} = \frac{10}{4} = 2\tfrac{1}{2} \text{ per cent.}$$

3. $1039681 \times 1039681 = 1080936581761,$

$328776 \times 328776 = 108093658176,$

$1080936581761 \div 108093658176 = 10{\cdot}000000000009\ldots$

4. To Saturday noon from Monday noon there are 24 × 5 or 120 hours;

∴ slow watch goes over 120 h. + 10 h. $49\frac{1}{11}$ min., or $7849\frac{1}{11}$ min. of its own time.

Now there are 1440 minutes in 24 hours, and while the slow watch goes over 1439 the quick watch goes over 1441;

∴ 1439 : 1441 :: $7849\frac{1}{11}$: number of minutes passed over by quick watch;

$$\therefore \text{quick watch goes over } \frac{86340 \times 1441}{11 \times 1439} = 60 \times 131 \text{ min.} = 131 \text{ hours,}$$

and therefore it will indicate 11 o'clock P.M.

5. Area of one end $= \frac{49}{4}$ sq. ft.;

∴ one edge $= \frac{7}{2}$ ft.;

∴ capacity of cistern $= \frac{7 \times 7 \times 7}{2 \times 2 \times 2}$ cub. ft. = 42 cub. ft. 1512 cub. in.

In 1 minute it fills $\frac{1}{10} + \frac{1}{12} - \frac{1}{15}$ or $\frac{7}{60}$;

∴ in 5 minutes it fills $\frac{35}{60}$ or $\frac{7}{12}$.

6. Let x = number of quarters.

Then $48x - 46x = 15 \times 20$,

$2x = 300$,

$x = 150$.

7. A's share $= \text{£}\,\frac{6800}{4} = \text{£}1700.$

B's share $= \text{£}\,\frac{6800 - 1700}{2} = \text{£}2550;$

∴ their joint shares = £4250.

Then 110 : 100 :: £4250 : the price *C* should pay;

$$\therefore \text{ sum required} = £\frac{4250 \times 100}{110} = £3863.\ 12s.\ 8\tfrac{1}{2}d.\ \tfrac{10}{11}q.$$

8. $$1000 \times 54s. = £2700.$$

Also, interest on £2700 for 7 months $= £\dfrac{7 \times 5 \times 2700}{12 \times 100} = £78.\ 15s.;$

$$\therefore \text{ his outlay} = (£2700 + £78.\ 15s. + £20) = £2798.\ 15s.$$

Now he loses $2\frac{1}{2} \times 10$, or 25 quarters, therefore he has only 975 to sell.

$$\text{Then } 975 \times 58s. = £2827.\ 10s.;$$

$$\therefore \text{ he gains } £2827.\ 10s. - £2798.\ 15s., \text{ or } £28.\ 15s.$$

9. $$A \text{ can mow 1 acre in } \frac{14}{3} \div \frac{5}{2} = \frac{28}{15} \text{ days,}$$

$$B \text{ can mow 1 acre in } \frac{7}{2} \div \frac{13}{6} = \frac{21}{13} \text{ days;}$$

$$\therefore \text{ in one day } A \text{ and } B \text{ mow } \left(\frac{15}{28} + \frac{13}{21}\right) \text{acres} = \frac{97}{84} \text{ acres;}$$

$$\therefore \frac{97}{84} : 10 :: 1 : \text{number of days required;}$$

$$\therefore \text{ number of days} = \frac{10 \times 84}{97} = 8\tfrac{64}{97}.$$

$$\text{Again, } \frac{28}{15} : \frac{840}{97} :: 1 : \text{number of acres mowed by } A;$$

$$\therefore A \text{ mows } \frac{840 \times 15}{28 \times 97} = 4\tfrac{62}{97} \text{ acres,}$$

$$\text{and } B \text{ mows } 10 - 4\tfrac{62}{97} = 5\tfrac{35}{97} \text{ acres.}$$

10. $$\begin{array}{rr} (£57{\cdot}084 \times 17{\cdot}57) = & £1002{\cdot}96588 \\ & 20 \\ \hline & 19{\cdot}31760\,s. \\ & 12 \\ \hline & 3{\cdot}81120\,d. \\ & 4 \\ \hline & 3{\cdot}24480\,q. \end{array}$$

$$\therefore \text{ result in English coinage} = £1002.\ 19s.\ 3\tfrac{3}{4}d.\ {\cdot}2448q.$$

11. While the first boy is copying 135 lines,

$$\text{the second} \ldots\ldots\ldots\ldots \frac{135 \times 2}{3},$$

$$\text{the third} \ldots\ldots\ldots\ldots \frac{135 \times 2 \times 6}{3 \times 5},$$

$$\text{the fourth} \ldots\ldots\ldots\ldots \frac{135 \times 2 \times 6 \times 8}{3 \times 5 \times 7},$$

$$\text{the fifth} \ldots\ldots\ldots\ldots \frac{135 \times 2 \times 6 \times 8 \times 10}{3 \times 5 \times 7 \times 9},$$

$$\text{the sixth} \ldots\ldots\ldots\ldots \frac{135 \times 2 \times 6 \times 8 \times 10 \times 14}{3 \times 5 \times 7 \times 9 \times 15};$$

∴ the sixth will copy 128 lines.

12. Whole capital = £5000,

of which £3000 has been paid up;

∴ £10217. 0*s*. $0\frac{3}{4}$*d*. + £2000 = available assets = £12217. 0*s*. $0\frac{3}{4}$*d*.;

∴ £15763. 17*s*. 6*d*. : £12217. 0*s*. $0\frac{3}{4}$*d*. :: £1 : what they pay in the pound;

$$\therefore \text{ they pay } £\frac{11728323}{15133320} = 15s.\ 6d.$$

APPENDIX.

MISCELLANEOUS PAPERS.

I. (p. 299.)

1.
$$\text{Since } \frac{2}{5}+\frac{5}{6}+\frac{1}{2}=\frac{26}{15}=1\tfrac{11}{15},$$
$$\text{and } \frac{3}{8}+\frac{7}{10}+\frac{3}{20}=\frac{49}{40}=1\tfrac{9}{40},$$
$$\text{and } 4-\frac{26}{15}-\frac{49}{40}=\frac{125}{120}=1\tfrac{1}{24};$$
$$\therefore A \text{ has } 1\tfrac{11}{15},\ B \text{ has } 1\tfrac{9}{40}, \text{ and } C \text{ has } 1\tfrac{1}{24}.$$

2. Each man works 66 hours in the week,

each woman works 55 hours in the week;

$\therefore$ the 25 men earn $(66\times3\times25)d.=4950d.$ in the week,

and the 20 women earn $(55\times2\times20)d.=2200d.$ in the week;

$\therefore$ annual expense of labour $=(7150\times52)d.=371800d.=£1549.\ 3s.\ 4d.$

3.
$$\left.\begin{array}{r@{\ :\ }r} 144 & 51 \\ 2\frac{1}{4} & 1\frac{1}{2} \\ 5 & 48 \\ 3 & 15 \\ 10 & 9 \end{array}\right\} :: 40 : x;$$

$$\therefore x=\frac{51\times\frac{3}{2}\times48\times15\times9\times40}{144\times\frac{9}{4}\times5\times3\times10}\text{ yds.}=\frac{51\times3\times24\times9\times4}{36\times9}\text{ yds.}$$
$$=(51\times8)\text{ yds.}=408\text{ yds.}$$

4.
$$\text{Interest for first year}=£\frac{345{\cdot}5\times3{\cdot}5}{100}=£12{\cdot}0925;$$
$$\therefore \text{simple interest for 2 years}=£(12{\cdot}9025\times2)=£24{\cdot}1850.$$

Interest for second year, reckoning compound interest,
$$=£\frac{357{\cdot}5925\times3{\cdot}5}{100}=£12{\cdot}5157375;$$

$\therefore$ compound interest for 2 years $= £(12·0925 + 12·5157375) = £(24·6082375)$.

Hence the difference $= £(24·6082375 - 24·1850) = £·4232375 = 8s.\ 5\tfrac{1}{2}d.\ ·308q.$

5. Since 2 ac. 3 ro. 5 po. $=$ 445 po. $= (445 \times 30\tfrac{1}{4})$ sq. yds.,

and 151 yds. 9 in. $= 151\tfrac{1}{4}$ yds.;

$$\therefore \text{breadth of field} = \frac{445 \times 30\frac{1}{4}}{151\frac{1}{4}}\text{ yds.} = \frac{445 \times 121}{605}\text{ yds.} = \frac{445}{5}\text{ yds.} = 89\text{ yds.}$$

6. $2^{\frac{1}{2}}$ is greater or less than $3^{\frac{1}{3}}$

as $2^{\frac{3}{6}}$ is greater or less than $3^{\frac{2}{6}}$,

as 2^3 is greater or less than 3^2,

as 8 is greater or less than 9.

But 8 is less than 9; therefore $2^{\frac{1}{2}}$ is less than $3^{\frac{1}{3}}$.

Also
$$\frac{5030·912}{65536} = \frac{2515·456}{32768} = \frac{1257·728}{16384} = \frac{314·432}{4096}$$
$$= \frac{157·216}{2048} = \frac{19·652}{256} = \frac{4·913}{64}.$$

Now
$$\sqrt[3]{\frac{4·913}{64}} = \frac{1·7}{4} = ·425.$$

7. Since $5\tfrac{1}{3} + 4\tfrac{1}{2} + 2\tfrac{1}{6} = 12$,

the quantity of black tea in the mixture $= \left(\dfrac{5\frac{1}{3}}{12} \times 16\right)$ lbs.,

.... green .... $= \left(\dfrac{4\frac{1}{2}}{12} \times 16\right)$ lbs.,

.... orange pekoe .... $= \left(\dfrac{2\frac{1}{6}}{12} \times 16\right)$ lbs.;

$$\therefore \text{worth of mixture} = \left(\frac{16 \times 16}{3 \times 12} \times 56\right)d. + \left(\frac{9 \times 16}{2 \times 12} \times 72\right)d. + \left(\frac{13 \times 16}{6 \times 12} \times 42\right)d.$$
$$= 398\tfrac{2}{9}d. + 36s. + 121\tfrac{1}{3}d.$$
$$= £3.\ 19s.\ 3\tfrac{5}{9}d.$$

8. $$\text{Equated time} = \frac{200 \times 14 + 300 \times 19}{200 + 300}\text{ mo.} = \frac{2800 + 5700}{500}\text{ mo.} = \frac{85}{5}\text{ mo.}$$
$$= 17\text{ mo.}$$

Again, since interest on £100 for 17 mo. at $3\tfrac{3}{4}$ per cent. $= £3\tfrac{3}{4} \times \dfrac{17}{12} = £5.\ 6s.\ 3d.$;

$\therefore$ £105. 6s. 3d. : £500 :: £100 : present value of the whole sum.

$$\text{Hence present value} = £\frac{500 \times 20 \times 12 \times 100}{25275} = £\frac{12000000}{25275} = £\frac{2400000}{5055}$$

$$= £\frac{480000}{1011} = £\frac{160000}{337} = £474.\ 15s.\ 6\tfrac{1}{2}d.\ \tfrac{118}{337}q.$$

9. The value of £100 would under the circumstances be

$$\frac{5}{7} \text{ of } £100 = £\frac{500}{7} = £71\tfrac{3}{7};$$

$$\therefore \text{the loss will} = £(89\tfrac{1}{3} - 71\tfrac{3}{7}) = £17\tfrac{19}{21} = £17.\ 18s.\ 1\tfrac{1}{7}d.$$

10.

$$\text{Since 20 per cent.} = \frac{1}{5},$$

$$\text{cost price} + \frac{1}{5} \text{ cost price} = 5s.\ 3d.;$$

$$\therefore \frac{6}{5} \text{ cost price} = 63d., \quad \therefore \text{cost price} = \frac{63 \times 5}{6}\ d. = 52\tfrac{1}{2}d. \text{ per lb.};$$

∴ for each lb. of the 6*s.* tea put in the mixture he loses
6*s.*—4*s.* 4½*d.*, or 1*s.* 7½*d.*;

and for each lb. of the 4*s.* tea put in the mixture he gains
4*s.* 4½*d.*—4*s.*, or 4½*d.*;

∴ the proportion in which he must mix them is
4½*d.* : 1*s.* 7½*d.*, or 9 : 39, or 3 : 13.

11.

$$\text{Area of walls} = 2 \times 13\tfrac{1}{2}(19\tfrac{3}{4} + 24\tfrac{1}{4}) \text{ sq. ft.}$$

$$= (27 \times 44) \text{ sq. ft.};$$

$$\therefore \text{area to be papered} = \frac{5}{6} \text{ of } (27 \times 44) \text{ sq. ft.} = \frac{5 \times 27 \times 44}{6 \times 9} \text{ sq. yds.} = (5 \times 22) \text{ sq. yds.}$$

$$\text{Also each piece of paper contains } \left(\frac{2\frac{3}{4}}{3} \times 12\right) \text{ sq. yds.};$$

$$\therefore \frac{2\frac{3}{4}}{3} \times 12 : 5 \times 22 :: 11s. : \text{cost in shillings};$$

$$\therefore \text{cost} = \frac{5 \times 22 \times 11 \times 3 \times 4}{11 \times 12} s. = (5 \times 22)s. = £5.\ 10s.$$

12.

$$4 : 260 :: £100 : \text{sum invested};$$

$$\therefore \text{sum invested} = £\frac{260 \times 100}{4} = £6500.$$

$$\text{Hence } 200 : 3 :: 6500 : \text{price of consols};$$

$$\therefore \text{price of consols} = \frac{6500 \times 3}{200} = 97\tfrac{1}{2}.$$

II. (p. 300.)

1.

$$\begin{array}{r|l} & 5\dot{7}2\dot{1}4\dot{0}9\dot{6}\ (7564 \\ & 49 \\ \hline 145 & 821 \\ & 725 \\ \hline 1506 & \ \ 9640 \\ & \ \ 9036 \\ \hline 15124 & \ \ \ 60496 \\ & \ \ \ 60496 \\ \hline \end{array} \qquad \begin{array}{r|l} & \dot{5}7\dot{2}\cdot1\dot{4}0\dot{9}6\dot{0}\ (23\cdot919 \\ & 4 \\ \hline 43 & 172 \\ & 129 \\ \hline 469 & \ \ 4314 \\ & \ \ 4221 \\ \hline 4781 & \ \ \ \ 9309 \\ & \ \ \ \ 4781 \\ \hline 47829 & \ \ \ \ 452860 \\ & \ \ \ \ 430461 \\ \hline & \ \ \ \ \ 22399 \end{array}$$

3. £1 : £1920·75 :: £·575 : amount he receives;

∴ amount received = £(1920·75 × ·575) = £1104·43125 = £1104. 4 f. 3 c. $1\frac{1}{4}$ m.

4. The income-tax amounts to $\frac{7}{240}$ of the rental.

The interest on the mortgage $= \frac{4000 \times 3\frac{1}{2}}{100} = 40 \times 3\frac{1}{2} =$ £140;

$$\therefore \text{rental} - \frac{7}{240} \text{ of rental} = £1568.\ 13s.\ 4d. + £140;$$

$$\therefore \frac{233}{240} \text{ of rental} = £1708.\ 13s.\ 4d.;$$

$$\therefore \text{rental} = \frac{240}{233} \text{ of } £1708.\ 13s.\ 4d. = \frac{240}{233} \text{ of } £1708\tfrac{2}{3}$$

$$= £\left(\frac{240}{233} \times \frac{5126}{3}\right) = £(80 \times 22) = £1760.$$

5. Cost of 25 vols. at 3*s.* = 75*s.*, and bidder's allowance

$$= \frac{75 \times 5}{100} s. = \frac{15}{4} s. = 3s.\ 9d.;$$

cost of 12 vols. at 5*s.* 3*d.* = 63*s.*, and bidder's allowance

$$= \frac{63 \times 7\frac{1}{2}}{100} s. = \frac{63 \times 15}{200} s. = 4s.\ 8\tfrac{7}{10}d.,$$

$$\text{auction duty} = \frac{(75 + 63) \times 2\frac{1}{2}}{100} s. = \frac{138 \times 5}{200} s. = \frac{69}{20} s. = 3s.\ 5\tfrac{4}{10}d.;$$

∴ purchaser pays $75s. + 63s. + 3s.\ 9d. + 4s.\ 8\frac{7}{10}d. + 3s.\ 5\frac{4}{10}d. = £7.\ 9s.\ 11\frac{1}{10}d.$

6. Cost of $3\frac{1}{2}$ cwt. at 5*s.* $4\frac{1}{2}$*d.* per lb. $= \left(\frac{7}{2} \times 112 \times \frac{129}{2}\right) d.$

$$= 2107s. = £105.\ 7s.$$

$$\text{cost of } 4\tfrac{1}{2}\text{ cwt. at } 3s.\ 3\tfrac{1}{2}d. \text{ per lb.} = \left(\frac{9}{2}\times 112\times\frac{79}{2}\right)d. = 1659s. = £82.\ 19s.;$$

$$\therefore \text{ cost of 8 cwt. of mixture} = £105.\ 7s. + £82.\ 19s. = £188.\ 6s.,$$

$$\text{and 20 per cent. on this sum} = \frac{1}{5} \text{ of } £188.\ 6s. = £37.\ 13\tfrac{1}{5}s.;$$

$$\therefore \text{ he has to make in all } £225.\ 19\tfrac{1}{5}s.$$

$$\text{He sells 5 cwt. at } 4s.\ 6d. \text{ per lb. for } \left(5\times 112\times\frac{9}{2}\right)s. = 2520s. = £126;$$

$$\therefore \text{ he must sell 3 cwt. for } £99.\ 19\tfrac{1}{5}s.$$

$$\therefore \text{ price per lb.} = \frac{£99.\ 19\frac{1}{5}s.}{3\times 112} = \frac{£33.\ 6\frac{2}{5}s.}{112} = \frac{£4.\ 15\frac{1}{5}s.}{16} = \frac{£1.\ 3\frac{4}{5}s.}{4}$$
$$= 5\tfrac{19}{20}s. = 5s.\ 11\tfrac{1}{4}d.\ \tfrac{3}{5}q.$$

7. $$\text{1 cubic inch of iron weighs as much as } \frac{15}{2} \text{ cub. in. of water,}$$

$$\text{1 cubic foot of iron weighs } \left(\frac{15}{2}\times 1000\right) \text{oz.,}$$

$$\text{1 cubic yard of iron weighs } \frac{15\times 1000\times 27}{2}\text{ oz.} = \frac{7500\times 27}{16}\text{ lbs.} = \frac{50625}{4}\text{ lbs.}$$
$$= 12656\tfrac{1}{4}\text{ lbs.} = 5 \text{ tons } 13 \text{ cwt. } 0 \text{ lbs. } 4 \text{ oz.}$$

8. Since 3 horses = 5 ponies,

6 horses = 10 ponies, the number required.

9. $$\text{In 30 days } A \text{ does } \frac{3}{5} \text{ of work;}$$

$$\therefore \text{ in 50 days } A \text{ does the work.}$$

$$\text{In 6 days } A \text{ and } B \text{ do } \frac{2}{5} \text{ of work;}$$

$$\therefore B \text{ does } \left(\frac{2}{5}-\frac{6}{50}\right) \text{ of work, or } \frac{14}{50}, \text{ or } \frac{7}{25};$$

$$\therefore \text{ in 1 day } B \text{ does } \frac{7}{6\times 25} \text{ or } \frac{7}{150} \text{ of the work;}$$

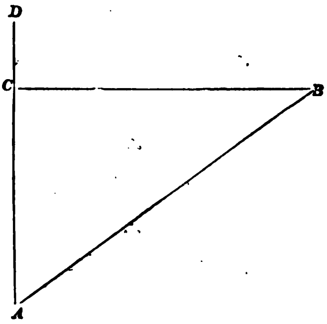
$$\therefore B \text{ does the work in } \frac{150}{7} \text{ days, or } 21\tfrac{3}{7} \text{ days.}$$

10. $$\text{Rate of interest in first case} = £\frac{100\times 2}{60} = £\frac{20}{6} = £3.\ 6s.\ 8d.,$$

$$\text{rate of interest in second case} = £\frac{100\times\frac{21}{10}}{56} = £\frac{210}{56} = £\frac{30}{8} = £3.\ 15s.;$$

$$\therefore \text{ advantage per cent.} = 8s.\ 4d. = £\frac{5}{12}.$$

11. Let A be the bottom of the lake,
CB the surface of the water,
D the tip of the lotus-bud,
and let x = depth of water.



Then $AD^2 = AB^2 = AC^2 + CB^2$,

or $(x+9)^2 = x^2 + (36)^2$,

or $x^2 + 18x + 81 = x^2 + 1296$,

or $18x = 1296$;

$\therefore x = \frac{1296}{18}$ in. $= 67\frac{1}{2}$ in. $= 5$ ft. $7\frac{1}{2}$ in.

12. A receives $\frac{1}{5}$ profits;

$\therefore B$ and C receive $\frac{4}{5}$ between them, and of this B receives $\frac{2}{3}$ and C $\frac{1}{3}$;

$\therefore B$ receives $\frac{8}{15}$ and C $\frac{4}{15}$.

Now $\frac{1}{2} : 40 :: 100 :$ capital on which A receives his profit;

$$\therefore A\text{'s capital} = \frac{40 \times 100}{\frac{1}{2}} = £8000;$$

$$\therefore \text{whole capital} = (5 \times £8000) = £40000;$$

$$\therefore C\text{'s capital} = \left(\frac{4}{15} \text{ of } £40000\right) = £10666.\ 13s.\ 4d.$$

13. Number of Great Nugget Shares $= \frac{1000}{7}$.

He sells these for £$\frac{5000}{7}$.

Number of Agua Frias $= \frac{500}{1\frac{1}{4}} = 400$.

He sells these for £2000.

He pays his broker on the four transactions $\frac{1}{400}$ £$\left\{1000 + \frac{5000}{7} + 500 + 2000\right\}$;

$$\therefore \text{he gains } £\left\{\frac{5000}{7} + 2000 - 1000 - 500\right\} - \frac{1}{4}£\left\{10 + \frac{50}{7} + 5 + 20\right\},$$

$$\text{or } £\left(\frac{5000}{7}+500-\frac{295}{28}\right),\ \text{or } £\left\{\frac{20000-295}{28}+500\right\},$$

$$\text{or } £\left\{\frac{19705}{28}+500\right\},\ \text{or } £1203.\ 15s.$$

III. (p. 301.)

1. (1) $$\left(\frac{2}{3}+\frac{5}{6}+\frac{7}{8}+\frac{11}{12}\right)\div\left(\frac{3}{4}-\frac{5}{8}\right)$$

$$=\frac{16+20+21+22}{24}\div\frac{6-5}{8}=\frac{79}{24}\div\frac{1}{8}=\frac{79}{3}=26\tfrac{1}{3}.$$

(2) $$\frac{7\frac{1}{2}}{6\frac{1}{2}}+\frac{11\frac{1}{2}-2\frac{2}{5}}{11\frac{1}{2}+2\frac{2}{5}}\times 10\tfrac{9}{13}-7\tfrac{1}{8}$$

$$=\frac{15}{13}+\frac{115-24}{115+24}\times\frac{139}{13}-\frac{57}{8}$$

$$=\frac{15}{13}+\frac{91}{13}-\frac{57}{8}=\frac{106}{13}-\frac{57}{8}=\frac{107}{104}=1\tfrac{3}{104}.$$

2. $$20\text{ oz. Av.}=\frac{20}{16}\text{ lb. Av.}=\frac{5}{4}\text{ of }7000\text{ grs. Troy}$$

$$=\left(\frac{5}{4}\text{ of }7000\text{ of }\frac{1}{5760}\right)\text{ lbs. Troy}$$

$$=\left(\frac{5}{4}\text{ of }7000\text{ of }\frac{1}{5760}\times 66\right)s.$$

$$=\frac{5\times 175\times 33}{288}s.=\frac{5\times 175\times 11}{96}s.=\frac{9625}{96}s.=£5.\ 0s.\ 3\tfrac{1}{8}d.$$

3. 3 × share of a younger daughter + (share of a younger daughter + £300)
+ $\frac{4}{3}$ (share of a younger daughter + £300) × 3 = £23100;

∴ (3 + 1 + 4) share of a younger daughter + £300 + £1200 = £23100;
∴ 8 × share of a younger daughter = £21600;
∴ share of a younger daughter = £2700,
share of elder daughter = £3000,
share of each son = £4000.

4. Take £100 as the sum of money.

Interest for the first year at 4 per cent. = £4,

.... second .... $= £\frac{104 \times 4}{100} = £\frac{416}{100} = £4{\cdot}16$;

∴ compound interest for 2 years = £8·16.

Hence rate of simple interest must be $\frac{8{\cdot}16}{2} = 4{\cdot}08$ per cent.

5. (1) Solid content = $8 \times 18 \times 18 \times 18$ cubic inches

$= (36 \times 36 \times 36)$ cubic inches;

∴ edge = 36 inches = 1 yard.

(2) 2 ac. 121 yds. = $(2 \times 4840 + 121)$ yds. = 9801 yds.;

∴ side = $\sqrt{9801}$ yds. = 99 yds.

6. Since 5 men = 15 boys, we may suppose 22 boys employed in the first case:

since 10 men = 30 boys, we may suppose 33 boys employed in the second case.

Then $\left.\begin{matrix} 33 : 22 \\ 125 : 75 \end{matrix}\right\}$ :: 15 : number of days required;

∴ number of days required $= \frac{22 \times 75 \times 15}{33 \times 125} = \frac{2 \times 3 \times 15}{3 \times 5} = 6$.

7. Stock purchased in the 3 per cents.

$= £\frac{100 \times 962\frac{1}{2}}{77} = £\frac{1925 \times 100}{77 \times 2} = £\frac{25 \times 100}{2} = £1250$;

this is sold for $£\frac{1250 \times 76}{100}$, or £25 × 38, or £950,

and this sum invested in the 4 per cents. at 95 produces £1000 stock.

Interest on first investment $= £\frac{1250 \times 3}{100} = £37.\ 10s.$,

interest on second investment $= £\frac{1000 \times 4}{100} = £40$;

∴ difference in income = £40 − £37. 10*s.* = £2. 10*s.*

8. Interest on £100 in first investment $= £\frac{100 \times 3}{96} = £\frac{100}{32} = £\frac{25}{8} = £3\frac{1}{8}$.

interest on £100 in second investment $= £\frac{100 \times \frac{15}{2}}{227} = £\frac{750}{227} = £3\frac{69}{227}$;

∴ since $\frac{69}{227}$ is greater than $\frac{1}{8}$, the second investment is the better.

9. Wholesale dealer sells at 110 that which cost 100 originally,

retail .... 110 + 55................................;

∴ consumer pays 65 per cent. as the profit of the sellers.

10.

$$\begin{array}{rrrrrr}
\text{yds.} & \text{ft.} & \text{in.} & \text{ft.} & \text{in.} & \\
9 & 2 & 6 = & 29 & 6 & \\
7 & 1 & 8 = & \underline{22} & \underline{8} & \\
 & & & 649 & 0 & \\
 & & & \underline{19} & \underline{8} & \underline{0''} \\
 & & \text{sq. ft.} & 668 & 8 & 0''
\end{array}$$

∴ area = 668 sq. ft. 96 sq. in. = 74 sq. yds. 2 sq. ft. 96 sq. in.

11. A pipe of wine contains (2 × 63 × 8 × 2) half-pints;

∴ number of half-pint bottles + 2 × number of pint bottles + 4 × number of quart bottles = 2 × 63 × 8 × 2,

and since there is the same number of each,

(1 + 2 + 4) number of each = 2 × 63 × 8 × 2,

7 × number of each = 2 × 63 × 8 × 2,

number of each = 2 × 9 × 8 × 2 = 12 × 24 = 24 dozen.

Again, he has to sell the wine for $£\frac{70\times 115}{100} = £\frac{805}{10} = £\frac{161}{2}$,

and he has (24 + 48 + 96) dozens of half-pints to sell;

∴ each dozen of half-pints is sold for $£\left(\frac{161}{2}\div 168\right) = £\frac{161}{2\times 168} = \frac{805}{84}$ *s.* = 9*s.* 7*d.*;

∴ each dozen of pints is sold for 19*s.* 2*d.*;

∴ each dozen of quarts is sold for £1. 18*s.* 4*d.*

12. 10 pints of the mixture sold as rum cost 15*s.*, ∴ 1 pint cost $\frac{15}{10}$ *s.*,

$10\frac{1}{2}$ .... gin cost 11*s.*, ∴ 1 pint cost $\frac{11\times 2}{21}$ *s.*,

11 .... brandy cost 22*s.*, ∴ 1 pint cost 2*s.*

Again 1 pint of the rum sold for 2*s.*,

1 pint of the gin sold for $\frac{12}{8}$ *s.*,

1 pint of the brandy sold for $\frac{23}{8}$ *s.*

Supposing then that he sells 1 pint of brandy, 2 pints of gin, and 4 pints of rum,

$$\text{cost price} = \left(2 + \frac{44}{21} + \frac{60}{10}\right)s. = \frac{212}{21}s.,$$

$$\text{selling price} = \left(\frac{23}{8} + \frac{24}{8} + 8\right)s. = \frac{111}{8}s.;$$

$$\therefore \text{gain} = \left(\frac{111}{8} - \frac{212}{21}\right)s. = \frac{635}{168}s.;$$

$$\therefore \frac{212}{21} : \frac{635}{168} :: 100 : \text{gain per cent.};$$

$$\therefore \text{gain per cent.} = \frac{635 \times 100 \times 21}{212 \times 168} = \frac{15875}{424} = 37\tfrac{187}{424}.$$

IV. (p. 302.)

1.

$$\begin{array}{r|r} & \cdot0\dot{0}0\dot{9}6\dot{1}\ (\cdot031 \\ & 9 \\ \hline 61 & 61 \\ & 61 \\ \hline \end{array}$$

$$\sqrt[3]{\cdot000027} = \cdot03;$$

$\therefore$ length of side = ($\cdot03 \times 36$) inches = 1·08 inches.

2.

$$\begin{array}{r} 92\cdot41035\,)\,2\cdot508928060\ (\cdot0271 \\ 18482070 \\ \hline 66072106 \\ 64687245 \\ \hline 13848610 \\ 9241035 \\ \hline 4607575 \end{array}$$

3. (1) 115 : 828 :: £100 : sum required;

$$\therefore \text{sum required} = £\frac{828 \times 100}{115} = £720.$$

(2) Interest on £100 for 175 days $= £\dfrac{3\cdot75 \times 175}{365} = £\dfrac{525}{292}$;

$$\therefore 100 + \frac{525}{292} : 100 :: £487\cdot525 : \text{present worth required};$$

$$\therefore \text{present worth} = £\frac{487\cdot525 \times 100 \times 292}{29725} = £478.\ 9\text{ f. }1\text{ c. }4\text{ m. nearly.}$$

4. 3*s*. 6*d*. × 350 = £61. 5*s*.,

(38*s*. 9*d*. + 27*s*. 4*d*. + 17*s*. 4*d*. + 33*s*. 10*d*.) × 100 = 117*s*. 3*d*. × 100 = £586. 5*s*.;

∴ whole rent = £61. 5*s*. + £586. 5*s*. = £647. 10*s*.

5. 20 men in 60 days build a wall (15×30) ft.;

$$\therefore \text{ 1 man in 1 day builds } \frac{15 \times 30}{20 \times 60} = \frac{3}{8} \text{ ft.;}$$

35 men in 64 days build a wall (20×40) ft.;

$$\therefore \text{ 1 man in one day builds } \frac{20 \times 40}{35 \times 64} = \frac{5}{14} \text{ ft.;}$$

$$\begin{aligned}\therefore \text{ strength of 1st class : strength of 2nd class } &:: \frac{3}{8} : \frac{5}{14} \\ &:: \frac{21}{56} : \frac{20}{56} \\ &:: 21 : 20.\end{aligned}$$

6. $\left.\begin{matrix} 100 : 135 \\ 3 : 4\frac{1}{2} \end{matrix}\right\} :: £97\frac{1}{8}$: value required;

$$\therefore \text{ value} = £\frac{135 \times 9 \times 777}{100 \times 3 \times 2 \times 8} = £\frac{314685}{1600} = £196.\ 13s.\ 6\tfrac{3}{4}d.$$

7. £3. 17*s.* 10½*d.* = 3738 farthings,
£1 = 960 farthings.

Now G. C. M. of 3738 and 960 is 6;

∴ 960 ÷ 6 = 160, the number of oz. required.

8. 94 : 98 :: £5000 : amount of stock required;

$$\therefore \text{ amount of stock} = £\frac{98 \times 5000}{94} = £5212\tfrac{36}{47}.$$

$$\text{Also, first income} = £\frac{5000 \times 3\frac{1}{4}}{100} = £(50 \times 3\tfrac{1}{4}) = £162.\ 10s.,$$

$$\text{and second income} = £\frac{98 \times 5000 \times 3}{94 \times 100} = £\frac{7350}{47} = £156.\ 7s.\ 7\tfrac{43}{47}d.;$$

∴ difference = £6. 2*s.* $4\frac{4}{47}$*d.*

9. *A* receives $\frac{1}{3}$ of £4. 7*s.* 6*d.*, or £1. 9*s.* 2*d.*;

B receives $\frac{1}{7}$ of £4. 7*s.* 6*d.*, or 12*s.* 6*d.*;

then *A* receives $\frac{4}{11}$ of (£4. 7*s.* 6*d.* — £2. 1*s.* 8*d.*) = $\frac{4}{11}$ of (£2. 5*s.* 10*d.*) = 16*s.* 8*d.*,

and *B* receives £2. 5*s.* 10*d.* — 16*s.* 8*d.* = £1. 9*s.* 2*d.*

Hence *A* receives in all £1. 9*s.* 2*d.* + 16*s.* 8*d.* = £2. 5*s.* 10*d.*,

and *B* receives in all 12*s.* 6*d.* + £1. 9*s.* 2*d.* = £2. 1*s.* 8*d.*

10. Number of lbs. saved $= \frac{1}{2}(63 \times 27)$ lbs. $= \frac{1701}{2}$ lbs. $= 850\frac{1}{2}$ lbs.,

and value $= \left(\frac{1701}{2} \times \frac{5}{2}\right) d. = £8.\ 17s.\ 2\frac{1}{4}d.$

11. D's debt $= £2085 - £(235 + 325 + 525) = £1000$;

$\therefore$ £1000 : £525 :: £1 : what he pays in the pound;

$\therefore$ he pays $£\frac{525}{1000} = \frac{525 \times 20}{1000} s. = 10s.\ 6d.$;

$\therefore$ A receives $\frac{21}{40}$ of £235 = £123. 7*s*. 6*d*.,

B receives $\frac{21}{40}$ of £325 = £170. 12*s*. 6*d*.,

C receives $\frac{21}{40}$ of £525 = £275. 12*s*. 6*d*.

12. Let $2x =$ work done by C in 1 day,

$4x =$ .... A ....,

$3x =$ .... B ....;

$\therefore$ $2x + 4x + 3x = 9x$, the work done by A, B and C in 1 day;

$\therefore$ $18x + 2x + 3x = 23x$, the work done by all three.

Now in one day A and C will do $6x$;

$\therefore$ time required $= \frac{23x}{6x} = 3\frac{5}{6}$ days.

V. (p. 303.)

1. In 2 weeks he saves $\frac{17s.\ 6d.}{5} = 3s.\ 6d.$;

$\therefore$ $3\frac{1}{2}s.$: $21 \times 50s.$ :: 2 weeks : number of weeks required;

$\therefore$ number of weeks $= \frac{21 \times 50 \times 2 \times 2}{7} = 600$.

2. $65s. \div 15s. = \frac{65}{15} = 4\frac{1}{3}$; and $65s. \div 15 = \frac{65}{15} s. = 4s.\ 4d.$

3. 60 men = 120 women,

and 120 + 104 = 224;

$$\therefore \text{ each woman receives } \frac{15\times 112}{224}\text{ lbs.} = \frac{15}{2}\text{ lbs.} = 7\tfrac{1}{2}\text{ lbs.};$$

$$\therefore \text{ each man receives } 15\text{ lbs.}$$

4. The number of square feet of matting to cover the top $= \dfrac{87\times 20\times 12}{4}$,

and since the pile is 10 yds. or 30 ft. in breadth,

$$\text{length of pile in ft.} = \frac{87\times 20\times 12}{4\times 30} = 174.$$

Then number of pieces of wood in the pile

$$= \frac{12\times 3\times 10\times 3\times 174}{18\times \frac{2}{3}\times \frac{1}{3}} = 3\times 3\times 10\times 3\times 174 = 46980.$$

5. $23\times 38s. = 874s.$: $24\times 39s. = 936s.$: $25\times 40s. = 1000s.$;

$$\therefore 72 \text{ quarters cost him } 2810s.;$$

$$\therefore 72 \text{ quarters must sell for } \left(2810 + \frac{2810}{5}\right)s.,\text{ or } 3372s.;$$

$$\therefore \text{ one quarter must sell for } \frac{3372}{72}s. = £2.\ 6s.\ 10d.$$

6. 95 : 97½ :: £2200 : amount of Railway Stock purchased;

$$\therefore \text{ amount of Railway Stock} = £\frac{2200\times 195}{95\times 2};$$

$$\text{and interest on this} = £\frac{2200\times 195\times 4\tfrac{3}{4}}{100\times 95\times 2} = £\frac{22\times 195\times 19}{4\times 95\times 2} = £107.\ 5s.$$

Also his interest from consols was $22\times 3 = £66$;

$$\therefore \text{ increase in his income} = £41.\ 5s.$$

7. Interest on 100*s.* for 9 months $= 3s.$;

∴ 103 : 21 :: 3*s.* : allowance required;

$$\therefore \text{ allowance} = \frac{21\times 3}{103}s. = 7\tfrac{1}{4}d.\ \tfrac{37}{103}q.$$

8. Square inches of French silk $= 39{\cdot}37\times 34{\cdot}45\times 27$.

Then $39{\cdot}37\times 39{\cdot}37$: $39{\cdot}37\times 34{\cdot}45\times 27$ :: 4 fr. : value in francs;

$$\therefore \text{ value in francs} = \frac{34{\cdot}45\times 27\times 4}{39{\cdot}37};$$

$$\therefore \text{ value in shillings} = \frac{34{\cdot}45\times 27\times 4\times 20}{39{\cdot}37\times 25{\cdot}15} = \frac{3445\times 27\times 4\times 20\times 100}{3937\times 2515}$$

$$\therefore \text{number of square feet} = \frac{689 \times 27 \times 4 \times 20 \times 100 \times 4}{3937 \times 503};$$

$$\therefore \text{number of linear feet} = \frac{689 \times 27 \times 4 \times 20 \times 100 \times 4}{3937 \times 503 \times 4};$$

$$\therefore \text{number of linear yards} = \frac{49608000}{1980311}$$

$$= 25\tfrac{100225}{1980311}.$$

9. $$\sqrt{\frac{\cdot00125}{\cdot18}} = \sqrt{\frac{\cdot000625}{\cdot09}} = \frac{\cdot025}{\cdot3} = \cdot08\dot{3},$$

$$\sqrt[3]{423564\cdot751} = 75\cdot1.$$

10. £2. 18*s.* 4*d.* : £3 :: £525000 : sum raised at 3 per cent.;

$$\therefore \text{sum raised} = £\frac{720 \times 525000}{700} = £540000;$$

$$\therefore \text{increase} = £540000 - £525000 = £15000.$$

11. Difference between the clocks in 1 day $= 15'' = \frac{1}{4}$ minute;

∴ time in which 30 minutes will be between them = 120 days.

Then first clock will be $\frac{120 \times 7}{60}$, or 14 minutes before 2,

and second clock will be $\frac{120 \times 8}{60}$, or 16 minutes past 2.

12. Interest on £105 for 1 year = £4. 4*s.*;

∴ amount in 10 years = £147;

$$\therefore \text{price per dozen} = \frac{147 \times 20}{52}s. = \frac{735}{13}s. = 56\tfrac{7}{13}s.$$

VI. (p. 303.)

1. (1)

```
·000917)7244·3(7900000
        6419
         8253
         8253
```

(2) $$\frac{1}{7} - \left(\frac{3}{35} + \frac{4}{55}\right) + \frac{6}{385}$$

$$= \frac{55}{385} - \frac{33}{385} - \frac{28}{385} + \frac{6}{385} = \frac{61-61}{385} = 0.$$

(3) $$\frac{\frac{5}{16}+\frac{7}{12}\text{ of }3\frac{1}{4}-\left(\frac{7}{8}\text{ of }\frac{37}{21}-\frac{1}{3}\right)}{\frac{5}{14}-\frac{3}{7}\text{ of }\frac{1}{2}}$$

$$=\frac{\frac{5}{16}+\frac{91}{48}-\frac{37}{24}+\frac{1}{3}}{\frac{5}{14}-\frac{3}{14}}=\frac{122-74}{48}\times\frac{14}{2}=7.$$

2. $$\begin{array}{r|cccccccccccl} & \text{m.} & & \text{f.} & & \text{po.} & & \text{yds.} & & \text{ft.} & & \text{in.} & \\ 3 & 5 & . & 0 & . & 20 & . & 3 & . & 0 & . & 6 & \\ \hline & 1 & . & 5 & . & 20 & . & 1 & . & 0 & . & 2 & =13\text{ fur.}+\frac{3998}{7920}\text{ fur.}=13\frac{1999}{3960}\text{ fur.} \end{array}$$

3. $$96\tfrac{7}{8}-82\tfrac{3}{4}=14\tfrac{1}{8};$$

$\therefore$ he loses $(£14\frac{1}{8}\times10)=£141.\ 5s.$

4. Legacy duty $=£150$;

$\therefore$ £1350 remains to be divided.

Now $£\,\frac{1350}{6}=£225$;

$\therefore$ the shares are £225, £450, and £675.

5. $101\frac{1}{3} : 237\frac{1}{2} :: £1\frac{1}{3}$: discount required;

$$\therefore\ \text{discount}=£\,\frac{475\times4\times3}{2\times3\times304}=£\,\frac{475}{152}=£3.\ 2s.\ 6d.$$

$$\text{Also interest}=£\,\frac{237\frac{1}{2}\times4}{100\times3}=£\,\frac{9\frac{1}{2}}{3}=£3.\ 3s.\ 4d.;$$

$\therefore$ difference $=10d.$ in favour of the man who pays the bill.

6. $$\text{Number of square metres}=10\times\frac{1}{3},$$

$$\therefore\ \text{value}=\left(\frac{10}{3}\times10\right)s.;$$

$$\therefore\ \text{number of feet of English cloth}\times1\tfrac{1}{2}\times3\times2\tfrac{1}{2}=\frac{100}{3};$$

$$\therefore\ \text{number of feet}=\frac{100\times2\times2}{3\times3\times3\times5}=\frac{80}{27}=2\text{ ft. }11\tfrac{5}{9}\text{ in.}$$

7. Since 50 per cent. increase on $£3=£4\frac{1}{2}$,

$\therefore\ 4\frac{1}{2} : 5 :: £96$: price of railway stock;

$$\therefore\ \text{price}=£\,\frac{5\times96\times2}{9}=£\,\frac{320}{3}=£106.\ 13s.\ 4d.$$

8. Number of square yards in the floor $= \dfrac{£6.\ 2s.\ 6d.}{5s.} = \dfrac{49}{2}$,

.... walls $= \dfrac{£2.\ 12s.\ 6d.}{9d.} = 70$;

$\therefore$ breadth × 2 breadth $= \dfrac{49}{2}$ yds.;

$\therefore$ $(\text{breadth})^2 = \dfrac{49}{4}$ yds.;

$\therefore$ breadth $= \dfrac{7}{2}$ yds., and $\therefore$ length $= 7$ yds.

Then 2 height $\left(7 + \dfrac{7}{2}\right) = 70$;

$\therefore$ height $= \dfrac{70}{21}$ yds. $= \dfrac{10}{3}$ yds. $= 10$ feet.

9. $4 : 3 :: 100$: price the consols should be at;

$\therefore$ price $= \dfrac{3 \times 100}{4} = 75$;

$\therefore$ the consols must be 25 below par.

10.
$$\frac{17}{12} = 1{\cdot}41\dot{6},$$
$$\frac{41}{29} = 1{\cdot}4137,$$

$\sqrt{2} = 1{\cdot}414$, which lies between the two former.

Again, $\sqrt[3]{669{\cdot}921875}$ cub. ft. $= 8{\cdot}75$ ft. $= 8\frac{3}{4}$ ft. $= 105$ inches.

11. $97\frac{1}{2} : 585 :: 100$: amount of Russian stock;

$\therefore$ Russian stock $= \dfrac{585 \times 100 \times 2}{195} = 600$;

$\therefore$ he has £1300 stock standing in his name.

Now on £700 he gains $£(7 \times \frac{1}{2}) = £3.\ 10s$,

and on £600 he loses $£(6 \times 1\frac{1}{4}) = £7.\ 10s.$;

$\therefore$ he loses £4.

12. 7 cwt. of coffee would cost $£(8\frac{1}{2} \times 7) = £59\frac{1}{2}$,

5 cwt. of chicory would cost $£(2\frac{1}{2} \times 5) = £12\frac{1}{2}$;

$\therefore$ 12 cwt. of mixture would cost £72;

$\therefore$ 1 cwt. of mixture would cost £6.

Then $100 : 116\frac{2}{3} :: £6$: selling price per cwt.;

$\therefore$ selling price per cwt. $= £\dfrac{350 \times 6}{100 \times 3} = £7.$

VII. (p. 304.)

1. 1st article costs per month $\frac{15}{9}s.$, or $\frac{5}{3}s.$, or $\frac{35}{21}s.$,

2nd article .... $\frac{12}{7}s.$, or $\frac{36}{21}s.$,

and therefore the 1st article is the cheaper.

Now the monthly saving by using the first is $\frac{1}{21}s.$;

$\therefore$ 4 wks. : 3 yrs. 33 wks. :: $\frac{1}{21}s.$: sum required;

$\therefore$ sum required $=\frac{189}{4\times 21}s.=\frac{9}{4}s.=2s.\ 3d.$

2. (1)
$$\frac{\frac{1}{3}\text{ of }\frac{1}{2}+\frac{3}{2}\text{ of }5}{9\frac{1}{3}-1\frac{2}{3}}=\frac{\frac{1}{6}+\frac{15}{2}}{\frac{28}{3}-\frac{5}{3}}=\frac{\frac{46}{6}}{\frac{23}{3}}=1.$$

(2)
$$\frac{\frac{2}{3}-\frac{1}{4}}{1\div\left(\frac{3}{10}-\frac{1}{2}\times\frac{1}{5}\right)}\text{ of }2s.=\frac{\frac{5}{12}}{1\div\frac{1}{5}}\text{ of }2s.=\frac{1}{12}\text{ of }2s.=2d.$$

(3)
$$\frac{2^7}{7\times 10^7}+\frac{2^3}{3\times 10^3}=\frac{128}{7\times 10^7}+\frac{8}{3\times 10^3}$$
$$=\frac{18\cdot\dot{2}8571\dot{4}}{10^7}+\frac{2\cdot 66666\dot{6}}{10^3}$$
$$=\cdot 000001 8\dot{2}8571\dot{4}+\cdot 00266666\dot{6}$$
$$=\cdot 00266684\dot{9}5238\dot{0}.$$

3. 1 acre = 160 sq. poles

= (4 × 4) poles × 10

= (100 × 100) links × 10

= 100000 links.

4. Let x = the debt;

then $\frac{19x}{20}$ = sum paid,

and $\frac{1}{20}$ of $\frac{19x}{20}$ = interest made on this payment;

$$\therefore x=\frac{19x}{20}+\frac{19x}{400}+5;$$

$$\therefore 400x=380x+19x+2000;$$

$$\therefore x=\pounds 2000.$$

5. $$\text{In one day } A \text{ and } B \text{ do } \frac{1}{10},$$

$$A \text{ and } C \text{ do } \frac{1}{12},$$

$$B \text{ and } C \text{ do } \frac{1}{16};$$

$$\therefore 2A \text{ and } B \text{ and } C \text{ do } \frac{1}{10}+\frac{1}{12};$$

$$\therefore 2A \text{ do } \frac{1}{10}+\frac{1}{12}-\frac{1}{16}, \text{ or } \frac{29}{240};$$

$$\therefore A \text{ does } \frac{29}{480}, \text{ and } \therefore A \text{ does it in } \frac{480}{29} \text{ or } 16\tfrac{16}{29} \text{ days};$$

$$B \text{ does } \frac{1}{10}-\frac{29}{480}=\frac{19}{480}, \therefore B \text{ does it in } 25\tfrac{5}{19} \text{ days};$$

$$C \text{ does } \frac{1}{12}-\frac{29}{480}=\frac{11}{480}, \therefore C \text{ does it in } 43\tfrac{7}{11} \text{ days}.$$

6. $$100 \text{ Zwanzigers}=100\times\frac{2001}{12500} \text{ scudi}$$

$$=\frac{2001}{125}\times\frac{125}{23} \text{ lire}$$

$$=87 \text{ lire}.$$

7. Let x = value of 4th house,

$\frac{5x}{6}$ = value of 3rd house,

$\frac{15x}{24}$ = value of 2nd house,

$\frac{30x}{72}$ = value of 1st house.

Then $$x+\frac{5x}{6}+\frac{15x}{24}+\frac{30x}{72}=1840;$$

$$\therefore x=\pounds 640;\quad \frac{5x}{6}=\pounds 533.\ 6s.\ 8d.;\quad \frac{15x}{24}=\pounds 400;\quad \frac{30x}{72}=\pounds 266.\ 13s.\ 4d.$$

8. Interest for 1 year in pence $= \dfrac{3\frac{1}{2} \times 12}{33\frac{1}{3}}$;

$$\therefore\ 3\tfrac{1}{2}d.\ :\ \frac{3\frac{1}{2} \times 12}{33\frac{1}{3}}\,d.\ ::\ 100 : \text{rate per cent.};$$

$$\therefore\ \text{rate per cent.} = \frac{3\frac{1}{2} \times 12 \times 100}{3\frac{1}{2} \times 33\frac{1}{3}} = \frac{12 \times 100}{\frac{100}{3}} = 12 \times 3 = 86.$$

9. $£2.\ 6s.\ 8d. + \dfrac{1}{10}$ of $£2.\ 6s.\ 8d. = £2.\ 6s.\ 8d. + 4s.\ 8d. = £2.\ 11s.\ 4d.$;

$$\therefore\ £3 : £2.\ 11s.\ 4d.\ ::\ 96\tfrac{3}{8} : \text{sum to be invested};$$

$$\therefore\ \text{sum to be invested} = £\,\frac{96\frac{3}{8} \times 51\frac{1}{3}}{3 \times 20} = £\,\frac{771 \times 154}{24 \times 60} = £\,\frac{19789}{240} = £82.\ 9s.\ 1d.$$

10.

$$\begin{array}{rr|l}
 & & 73\dot{1}18\dot{9}18772\dot{9}\ (9009 \\
 & & 729 \\ \cline{3-3}
3 \times (9000)^2 = & 243000000 & \quad 2189187729 \\
3 \times 9000 \times 9 = & 243000 & \\
9^2 = & 81 & \\ \cline{2-2}
 & 243243081 \times 9 = & \quad 2189187729 \\ \cline{3-3}
\end{array}$$

11. For each sheep he gave $£\,\dfrac{108}{117} = £\,\dfrac{12}{13}$.

$$\text{For 18 he obtains } £18\left(\frac{12}{13} - \frac{1}{5}\right) = £\,\frac{846}{65};$$

$$\therefore\ \text{he has to sell 96 for } £113 - £\,\frac{846}{65};$$

$$\therefore\ \text{price of each} = £\,\frac{113 - \frac{846}{65}}{96} = £\,\frac{6499}{6240} = £1.\ 0s.\ 9\tfrac{3}{4}d.\ \tfrac{11}{13}q.$$

12. Area of walls $= 2 \times 12{\cdot}4\ \{27{\cdot}7 + 19{\cdot}55\}$ sq. ft.

$= 24{\cdot}8 \times 47{\cdot}25$ sq. ft.;

$$\therefore\ \text{length of paper in feet} = \frac{24{\cdot}8 \times 47{\cdot}25}{2{\cdot}7};$$

$$\therefore\ \text{length of paper in yards} = \frac{24{\cdot}8 \times 47{\cdot}25}{2{\cdot}7 \times 3};$$

$$\therefore\ \text{price of paper} = \frac{24{\cdot}8 \times 47{\cdot}25 \times 15}{2{\cdot}7 \times 3}\,d.$$

$$= \frac{248 \times 47{\cdot}25 \times 5}{27}\,d.$$

$$= 248 \times 1{\cdot}75 \times 5d. = 2170d. = £9.\ 0s.\ 10d.$$

VIII. (p. 305.)

1. $$\frac{102}{136}=\frac{51}{68}=\frac{3}{4}=\cdot75.$$

2. $$\frac{3}{4\frac{1}{2}}\text{ of }4s.\ 7d.=\frac{3\times2}{9}\text{ of }55d.=3s.\ 0\tfrac{2}{3}d.,$$

$$2\cdot35\text{ of }1s.=2s.\ 4\cdot2d.=2s.\ 4\tfrac{1}{5}d.,$$

$$\cdot2375\text{ of }£1=4\cdot75s.=4s.\ 9d.;$$

$$\therefore\text{ sum required}=10s.\ 1\tfrac{13}{15}d.;$$

$$\therefore\text{ decimal}=\frac{121\frac{13}{15}d.}{126d.}=\frac{914}{945}=\cdot96719\ldots$$

3. $$\sqrt{\cdot142857\times3\tfrac{1}{9}\text{ sq. yds.}}=\sqrt{\cdot015873\times28\text{ sq. yds.}}=\sqrt{\cdot444444\text{ sq. yds.}}$$
$$=\cdot666\ldots\text{yds.}$$

$$\sqrt[3]{41\cdot421736\text{ cub. ft.}}=3\cdot46\text{ ft.}=41\cdot52\text{ inches.}$$

4. Interest due at end of first half-year $=£\dfrac{1200\times5}{100}=£60,$

.... second .... $=£\dfrac{1260\times5}{100}=£63,$

.... third .... $=£\dfrac{1323\times5}{100}=£66.\ 3s.;$

∴ amount in a year and a half = £1323 + £66. 3s. = £1389. 3s.

Again, interest for 4 years at 10 per cent. $=£\dfrac{1200\times10\times4}{100}=£480;$

∴ amount in 4 years = £1200 + £480 = £1680.

5. Amount of oxygen $=\dfrac{21}{100}$ of 25 cub. ft. 700 cub. in.

$$=\frac{21}{4}\text{ of 1 cub. ft. 28 cub. in.}$$

$$=\left(\frac{21\times1756}{4}\right)\text{cub. in.}=9219\text{ cub. in.}=5\text{ cub. ft. }579\text{ cub. in.}$$

6. Let x = rate of discount.

Then, since present worth + interest on present worth = debt,

$$533\tfrac{1}{3}+\frac{533\frac{1}{3}\times x\times2}{100}=560;$$

$$\therefore \frac{1600}{3} + \frac{1600 \times x}{3 \times 50} = 560;$$

$$\therefore 1600 + 32x = 1680;$$

$$\therefore 32x = 80;$$

$$\therefore x = 2\tfrac{1}{2}.$$

7. Area of table $= (6\tfrac{428571}{999999} \times 1\tfrac{71}{90})$ sq. yds.

$= (6\tfrac{3}{7} \times 1\tfrac{71}{90})$ sq. yds.;

$\therefore$ cost required $= \left(\frac{45}{7} \times \frac{161}{90} \times 9 \times 144 \times 25\right)s.$

$= (23 \times 9 \times 72 \times 25)s.$

$= £18630.$

8. Let x = cost of watch.

Then $\frac{5x}{100}$ or $\frac{x}{20}$ = amount of duty;

$$\therefore x + \frac{x}{20} = 30;$$

$$\therefore 21x = 600, \text{ or } x = \frac{200}{7};$$

$\therefore$ duty $= £\frac{200}{7 \times 20} = £\frac{10}{7} = £1.\ 8s.\ 6\tfrac{6}{7}d.$

9. $£20 = (25{\cdot}7 \times 20)$ francs

$= \frac{25{\cdot}7 \times 20 \times 42}{20}$ lire

$= 25{\cdot}7 \times 42$ lire

$= 1079\tfrac{2}{5}$ lire.

10. $2d.$ per sack made a difference of £10 to the dealer,

$\therefore$ number of sacks $= \frac{10 \times 20 \times 12}{2} = 1200;$

$\therefore$ weight of a sack $= \frac{80 \times 20}{1200}$ cwt. $= \frac{4}{3}$ cwt. $= 1$ cwt. $1\tfrac{1}{3}$ qr.;

$\therefore \frac{4}{3} : 80 \times 20 :: 1\tfrac{1}{2}s.$: what he sold his coals for;

$\therefore$ selling price of coals $= \frac{80 \times 20 \times 3 \times 3}{4 \times 2}\,s. = 1800s. = £90;$

$\therefore$ he gave £86 for them;

$\therefore$ price per ton $= £\frac{86}{80} = £1.\ 1s.\ 6d.$

11. Since 15 men in 24 × 9 hours do $\frac{3}{5}$ of the work,

1 man in 1 hour does $\frac{3}{15 \times 24 \times 9 \times 5}$ of the work;

$\therefore$ 18 men in 1 hour do $\frac{3 \times 18}{15 \times 24 \times 9 \times 5}$, or $\frac{1}{300}$ of the work.

The question then is, how many hours must these men work to complete $\frac{2}{5}$ of the work, which remains to be done?

And $\frac{1}{300} : \frac{2}{5} ::$ 1 hour : number of hours required;

$\therefore$ number of hours $= \frac{300 \times 2}{5} = 120$;

and, as 12 days remain for them to finish the work in,

$\frac{120}{12}$, or 10, is the number of hours a day they must work.

12. 7 doz. of wine at 68*s.* cost 476*s.*,

$\frac{130 \cdot 4}{2 \cdot 7}$ doz. at 38*s.* cost $\frac{49552}{27}$ *s.*;

$\therefore \left(7 + \frac{1304}{27}\right)$ doz. cost $\left(476 + \frac{49552}{27}\right)$ *s.*,

or $\frac{1493}{27}$ doz. cost $\frac{62404}{27}$ *s.*;

$\therefore$ 1 doz. cost $\frac{62404}{1493}$ *s.*;

$\therefore$ he gains on 1 doz. $\left(46 - \frac{62404}{1493}\right)$ *s.* $= \frac{6274}{1493}$ *s.*;

$\therefore \frac{62404}{1493} : 100 \times 20 :: \frac{6274}{1493 \times 20}$: gain per cent.;

$\therefore$ gain per cent. $= \frac{100 \times 6274 \times 1493}{62404 \times 1493} = \frac{627400}{62404} = 10\frac{840}{15601}$.

IX. (p. 306.)

1.
$$\begin{array}{r} 1000000 \\ 99009 \\ \hline 900991 \end{array} \qquad \frac{101}{1000} - \frac{1}{1000000} = \frac{100999}{1000000} = \cdot 100999,$$

9 lbs. 3 oz. $12\frac{1}{2}$ dwts. × 6240 = $2232\frac{1}{2}$ × 6240 = 13930800 dwts. = 58045 lbs.

2. (1) $$\frac{4}{5}\text{ of }\frac{3}{7}\text{ of }\frac{7\frac{1}{2}}{126}=\frac{4\times3\times15}{5\times7\times2\times126}=\frac{3}{7\times21}=\frac{1}{49}.$$

(2) $$\frac{1}{4}\text{ of }1\tfrac{3}{5}\div\frac{3}{5}\text{ of }\frac{4}{9}=\frac{1}{4}\times\frac{8}{5}\times\frac{5}{3}\times\frac{9}{4}=\frac{3}{2}=1\tfrac{1}{2},$$

$$16\tfrac{1}{4}\text{ ft.}\div2\tfrac{1}{10}=\frac{65\times10}{4\times21}\text{ ft.}=\frac{325}{42}\text{ ft.}=7\text{ ft. }8\tfrac{6}{7}\text{ in.}$$

3. (1) $$\cdot0025=\frac{25}{10000}=\frac{5}{2000}=\frac{1}{400},$$

$$\frac{3}{125}=\frac{24}{1000}=\cdot024,$$

$$6\tfrac{3}{40}=6\tfrac{75}{1000}=6\cdot075,$$

$$\frac{17}{25}=\frac{68}{100}=\cdot68,$$

and $\cdot024+6\cdot075-\cdot68=6\cdot099-\cdot68=5\cdot419.$

(2) $$1\cdot25\times\cdot072=\cdot09.$$

(3) $$\cdot010101\div\cdot02=\cdot50505,$$

$$120\div\cdot0048=25000,$$

$$56\cdot25\div1\cdot25=45.$$

4. $$\left.\begin{array}{rcl}12 & : & 11\\ 20\times4840 & : & 360\times320\\ 4 & : & 11\end{array}\right\}::3:\text{number of men required};$$

$$\therefore\text{ number of men}=\frac{360\times320\times11\times11}{12\times20\times4840\times4}=9.$$

5. Let x = a man's share,

then $\frac{3x}{5}$ = a woman's share,

and $\frac{18x}{35}$ = a boy's share;

$$\therefore 7x+9\times\frac{3x}{5}+3\times\frac{18x}{35}=488;$$

$$\therefore 245x+189x+54x=488\times35;$$

$$\therefore 488x=488\times35;$$

$\therefore x=35$, a man's share; so the men receive 35×7, or 245 guineas.

Also $\frac{8}{5}$ of $35=21$, a woman's share; so the women receive 21×9, or 189 guineas, and $\frac{6}{7}$ of $21=18$, a boy's share; so the boys receive 18×3, or 54 guineas.

6. First year's dividend $=£\frac{4800\times 4}{80}=£240$,

second year's dividend $=£240+£\frac{240\times 4}{80}=£240+£12=£252$,

third year's dividend $=£252+£\frac{252\times 4}{80}=£252+£12.\ 12s.=£264.\ 12s.$

7. In one day A and B do $\frac{1}{6}$,

B and C do $\frac{1}{7}$,

A, B and C do $\frac{1}{4}$;

$\therefore$ in one day C does $\frac{1}{4}-\frac{1}{6}$, or $\frac{1}{12}$,

A does $\frac{1}{4}-\frac{1}{7}$, or $\frac{3}{28}$;

$\therefore$ A and C do $\frac{1}{12}+\frac{3}{28}$, or $\frac{16}{84}$;

$\therefore$ A and C do the work in $\frac{84}{16}$, or $5\frac{1}{4}$ days.

8. Interest on £250 for one year $=£\frac{250\times 2\frac{1}{2}}{100}=£6\frac{1}{4}$.

$\therefore$ number of years required $=\frac{250}{6\frac{1}{4}}=\frac{250\times 4}{25}=40$.

9. Interest for 5 years $=£\frac{254{\cdot}408\times 3\frac{1}{2}\times 5}{100}=£44{\cdot}5214$;

$\therefore$ amount $=£(254{\cdot}408+44{\cdot}5214)=£298.\ 9\text{ f. } 2\text{ c. } 9{\cdot}4\text{ m.}$

10. Area of walls $=2\times 18\frac{5}{12}(20\frac{5}{6}+22\frac{3}{4})$ sq. ft. $=(36\frac{5}{6}\times 43\frac{7}{12})$ sq. ft.

area of door $=(7\frac{1}{2}\times 3\frac{1}{3})$ sq. ft.,

area of windows $=2(3\frac{1}{2}\times 5\frac{1}{3})$ sq. ft.;

$$\therefore \text{ area to be papered} = (36\tfrac{5}{8} \times 43\tfrac{7}{12} - 7\tfrac{1}{2} \times 3\tfrac{1}{3} - 2 \times 3\tfrac{1}{2} \times 5\tfrac{1}{6}) \text{ sq. ft.}$$

$$= \left(\frac{115583}{72} - 25 - \frac{217}{6}\right) \text{ sq. ft.}$$

$$= \frac{111179}{72} \text{ sq. ft.};$$

$$\therefore \text{ cost} = \left(\frac{111179}{72} \times \frac{1}{9} \times \frac{165}{4}\right) d. = \frac{6114845}{864} d. = £29.\ 9s.\ 9\tfrac{1}{4}d.\ \tfrac{101}{216}q.$$

11.

$$4\tfrac{1}{2} = \frac{1}{4} \times 3 + \frac{1}{2} \times \text{time required};$$

$$\therefore \frac{9}{2} - \frac{3}{4} = \frac{1}{2} \times \text{time required};$$

$$\therefore \text{ time required} = \frac{15}{4} \times 2 = 7\tfrac{1}{2} \text{ months.}$$

12. The bin contains $(40 \times 8 \times 2218{\cdot}192)$ cubic inches

$= (320 \times 2218{\cdot}192)$ cubic inches

$= 709821{\cdot}44$ cubic inches.

Now cube root of $709821{\cdot}440 = 89{\cdot}2$ nearly;

$\therefore$ length of edge $= 89{\cdot}2$ inches nearly

$= 7$ ft. $5\tfrac{1}{10}$ in. nearly.

13. Let x = original capital,

then $\frac{4x}{3}$ = capital at end of 1st year,

$\frac{16x}{9}$ = ... 2nd .... ,

$\frac{64x}{27}$ = ... 3rd .... ,

$\frac{256x}{81}$ = ... 4th .... .

Then

$$\frac{256x}{81} \times \frac{4\tfrac{1}{2}}{100} = 270;$$

$$\therefore x = £\frac{270 \times 81 \times 100 \times 2}{256 \times 9} = £\frac{30375}{16} = £1898.\ 8s.\ 9d.$$

X. (p. 308.)

1. Let x = breadth of the river,

then $(65)^2 = x^2 + (50)^2$;

$$\therefore x^2 = (65)^2 - (50)^2 = 1725;$$

$$\therefore x = \sqrt{1725} = 41 \cdot 53 \ldots \text{ feet.}$$

2. Amount of joint expenses = £25. 16*s.* + £15. 17*s.* = £41. 13*s.*;

Now *A*'s share of this $= \frac{7}{12}$ of £41. 13*s.* $= \frac{\text{£}291.\ 11s.}{12}$ = £24. 5*s.* 11*d.*;

∴ *A* has to receive from *B* £25. 16*s.* − £24. 5*s.* 11*d.* = £1. 10*s.* 1*d.*

3. 25 sec. : 1 hour :: 11 × 60 yds. : number of yards passed over in 1 hour;

$$\therefore \text{number of yards} = \frac{11 \times 60 \times 60 \times 60}{25};$$

$$\therefore \text{number of miles} = \frac{11 \times 60 \times 60 \times 60}{25 \times 1760} = 54.$$

Also, since 20 is the G. C. M. of 60 and 1760,

and 60 = 20 × 3;

∴ 3 miles is distance required.

4. Weekly receipts = £2683. 7*s.* 6*d.* + £2117. 8*s.* = £4800. 15*s.* 6*d.*,

monthly receipts = (£4800. 15*s.* 6*d.*) × 4 = £19203. 2*s.*,

annual receipts = £19203. 2*s.* × 13 = £249640. 6*s.*,

annual expenses = £13303. 7*s.* 2*d.* × 12 = £159640. 6*s.*;

∴ annual profits = £249640. 6*s.* − £159640. 6*s.* = £90000;

∴ 2000000 : 100 :: £90000 : interest required;

$$\therefore \text{interest} = \text{£}\,\frac{90000 \times 100}{2000000} = 4\tfrac{1}{2} \text{ per cent.}$$

5. (£1. 19*s.* 10½*d.*) × 567 = 1085238 farthings,

(£2. 2*s.* 6½*d.*) × 1161 = 2370762 farthings;

∴ whole cost = 3456000 farthings,

$$\text{and } \left(3456000 + \frac{12}{100} \text{ of } 3456000\right) \text{farthings}$$

$$= (3456000 + 414720) \text{ farthings} = 3870720 \text{ farthings.}$$

Also (567 + 1161) × 112 = 193536, number of lbs. in mixture;

$$\therefore \text{selling price per lb.} = \frac{3870720}{193536} \text{ farthings} = 20 \text{ farthings} = 5d.$$

6. $(\pounds 20.\ 10s.) \times 50 = \pounds 1025,$

$(\pounds 7.\ 15s.) \times 100 = \pounds 775;$

$\therefore$ his outlay is £1800;

and he receives $(6s.\ 8d.) \times 150$, or £50 per annum;

$\therefore$ 1800 : 100 :: £50 : interest required;

$$\therefore \text{interest} = \pounds\frac{100 \times 50}{1800} = \pounds\frac{25}{9} = \pounds 2\tfrac{7}{9}.$$

7. Let x = number of quarters of inferior wheat in the mixture,

y = ... superior ....;

Then cost price $= 39x + 48y$.

Now to gain 25 per cent. is to sell for $\frac{5}{4}$ of the cost price;

$$\therefore \frac{5}{4}(39x + 48y) = \text{selling price} = 57\tfrac{1}{2}(x + y);$$

$$\therefore \frac{195x + 240y}{4} = \frac{115x + 115y}{2};$$

$$\therefore 195x + 240y = 230x + 230y;$$

$$\therefore 10y = 35x, \text{ or } 2y = 7x;$$

$\therefore$ he must mix them in the proportion of 2 : 7.

8. A can give B 15 points in 50,

A can give C 20 points in 50;

$\therefore$ B can give C 5 points in 50;

$\therefore$ B can give C 1 point in 10;

$\therefore$ B can give C 7 points in 70.

9. $56s. \times 225 = \pounds 630,$

$$\text{and interest on } \pounds 630 \text{ for 1 year} = \pounds\frac{630 \times 3\frac{1}{2}}{100} = \pounds 22.\ 1s.$$

Now from Sept. 28 to March 25 there are 178 days;

$$\therefore \text{interest for that time} = \frac{(\pounds 22.\ 1s.) \times 178}{365} = \pounds 10.\ 15\tfrac{23}{365}s.$$

Hence amount the man has on March 25 $= \pounds 640.\ 15\tfrac{23}{365}s.$

Also, since $(225 \times 94)s. = \pounds 1057.\ 10s.,$

he would have gained

$$\pounds 1057.\ 10s. - \pounds 640.\ 15\tfrac{23}{365}s. = \pounds 416.\ 14\tfrac{342}{365}s. = \pounds 416.\ 14s.\ 11\tfrac{89}{365}d.$$

10. $102\frac{1}{2} : 100 :: £100$: present value of £100;

$$\therefore \text{ present value of } £100 = £\frac{100 \times 100 \times 2}{205} = £\frac{20000}{205};$$

$$\therefore \text{ credit price : present price} :: 100 : \frac{20000}{205}$$

$$:: 20500 : 20000$$

$$:: 205 : 200$$

$$:: 41 : 40.$$

11. (1) Let x = the sum,

$$\text{then } x + \frac{x \times 10 \times 5}{100} = £10000;$$

$$\therefore \frac{3x}{2} = £10000, \therefore x = £\frac{20000}{3} = £6666.\ 13s.\ 4d.$$

(2) For each £100 stock I receive £3—1*s*. 9*d*., or £2. 18*s*. 3*d*. interest;

$\therefore £3\frac{1}{2} : £2.\ 18s.\ 3d. :: 100$: price required;

$$\therefore \text{ price} = \frac{2\frac{219}{240} \times 100}{3\frac{1}{2}} = \frac{699 \times 100 \times 2}{7 \times 240} = \frac{10 \times 233}{7 \times 4} = \frac{1165}{14} = 83\frac{3}{14}.$$

12. Value of £5000000 in the 3 per cents. $= £\frac{5000000 \times 95}{100} = £4750000$;

$\therefore$ the lender has (£5000000—£4750000) = £250000 to be invested in the $3\frac{1}{4}$ per cents.

Now the price of the $3\frac{1}{4}$ per cents. will be thus found:

$3 : 3\frac{1}{4} :: 95$: price required;

$$\therefore \text{ price} = \frac{95 \times 13}{3 \times 4}.$$

Then $\frac{95 \times 13}{3 \times 4} : 250000 :: £100$: amount of stock required;

$$\therefore \text{ amount of stock} = £\frac{250000 \times 100 \times 3 \times 4}{95 \times 13} = £\frac{60000000}{247} = £242914\frac{242}{247}.$$

XI. (p. 308.)

1. Half the circumference of the Earth = 12500 miles;

$\therefore$ 288000 : 12500 :: 1 sec. : number of seconds required;

$$\therefore \text{ number of seconds} = \frac{12500}{288000} = \frac{25}{576} = \cdot 043402\dot{7}.$$

2. $$6+5+3=14;$$

$$\therefore \text{ senior partner receives } \frac{6}{14} \text{ of } £2100=6\times £150=£900,$$

$$\text{second} \;\ldots\ldots\ldots\ldots\ldots\ldots\; \frac{5}{14} \text{ of } £2100=5\times £150=£750.$$

$$\text{Each of the other partners has } \frac{1}{14} \text{ of } £2100=£150.$$

3. $$\text{Cost required}=\left(\frac{1760}{2}\times\frac{47}{3}\times 8\tfrac{1}{2}\right)d.$$

$$=\frac{440\times 47\times 17}{3}\,d.=\frac{351560}{3}\,d.=£488.\ 5s.\ 6\tfrac{2}{3}d.$$

4. Cost of 73 lbs. at 3*s.* $1\frac{1}{2}$*d.* = 10950 farthings,

cost of 182 lbs. at 3*s.* $5\frac{1}{2}$*d.* = 30212 farthings,

$\therefore$ cost of 255 lbs. in all = 41162 farthings.

Also he sells 255 lbs. at 4*s.* for $(255\times 12\times 4\times 4)$ farthings;

$\therefore$ 41162 : $255\times 112\times 4\times 4$ :: 100 : 100 + gain per cent.;

$$\therefore 100+\text{gain per cent.}=\frac{100\times 255\times 112\times 4\times 4}{41162}=\frac{2448000}{20581}=118\tfrac{19442}{20581};$$

$$\therefore \text{gain per cent.}=18\tfrac{19442}{20581}.$$

5. $$4\tfrac{1}{2} : 3\tfrac{1}{2} :: 100 : \text{price of stock};$$

$$\therefore \text{price of stock}=\frac{100\times 7\times 2}{9\times 2}=\frac{700}{9}=77\tfrac{7}{9}.$$

$$\frac{700}{9} : 100 :: £1200 : \text{amount of stock to be purchased};$$

$$\therefore \text{amount of stock}=£\frac{1200\times 100\times 9}{700}=£\frac{10800}{7}=£1542.\ 17s.\ 1\tfrac{5}{7}d.$$

6. Interest on £3. 6*s.* 8*d.* for 18 months comes to 5 shillings;

$$\therefore \text{Interest for 12 months comes to } \frac{5\times 2}{3}\,s.$$

Then $$66\tfrac{2}{3}s. : \frac{5\times 2}{3}\,s. :: 100 : \text{rate of discount};$$

$$\therefore \text{rate}=\frac{100\times 5\times 2}{200}=\frac{1000}{200}=5 \text{ per cent.}$$

7. $$\text{Value of 1 lb. Troy of } \textit{pure} \text{ gold}=\frac{£46.\ 14s.\ 6d.\times 12}{11}=\frac{11214}{11}\,s.;$$

$$\therefore \text{1 lb.} : \text{7 dwts. 11 gr.} :: \frac{11214}{11}\,s. : \text{value of a rupee of } \textit{pure} \text{ gold};$$

$$\therefore \text{ value of a rupee of } \textit{pure} \text{ gold} = \frac{11214\times179}{11\times12\times20\times24};$$

$$\therefore \text{ value of the alloyed rupee} = \frac{122}{1000}\times\frac{11214\times179}{11\times12\times20\times24}\,s.$$

$$= \frac{61\times5607\times179}{500\times11\times10\times6}\text{ farthings}$$

$$= \frac{61222833}{330000}\text{ farthings}$$

$$= 3s.\ 10\tfrac{1}{4}d.\ \tfrac{57611}{110000}q.$$

8. $$88 : 1250 :: £3 : \text{income required},$$

$$\therefore \text{ income} = £\,\frac{1250\times3}{88} = £\,\frac{1875}{44} = £42.\ 12s.\ 3\tfrac{3}{11}d.;$$

$$88 : 92 :: £1250 : \text{money obtained by selling out},$$

$$\therefore \text{ money obtained} = £\,\frac{1250\times92}{88};$$

$$\therefore \text{ interest on this at 4 per cent.} = £\,\frac{12\tfrac{1}{2}\times92\times4}{88} = £\,\frac{50\times23}{22} = £52.\ 5s.\ 5\tfrac{5}{11}d.;$$

$$\therefore \text{ increase in income} = £52.\ 5s.\ 5\tfrac{5}{11}d. - £42.\ 12s.\ 3\tfrac{3}{11}d. = £9.\ 13s.\ 2\tfrac{2}{11}d.$$

10.

$$\begin{array}{rr|l}
 & & \dot{8}06\dot{0}15\dot{0}12\dot{5}\ (2005 \\
 & & 8 \\ \cline{3-3}
3\times(2000)^2= & 12000000 & \quad 60150125 \\
3\times2000\times5= & 30000 & \\
5^2= & 25 & \\ \cline{2-2}
 & 12030025\times5= & \quad 60150125 \\ \cline{3-3}
\end{array}$$

11. $$\text{For } £1000 \text{ I pay as interest } £30,$$

$$\text{for interest at end of first half-year I receive } 10\times2\tfrac{1}{2} = £25,$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{ second } \ldots\ldots\ldots\ldots\ldots\ldots £\left(25+\frac{25\times2\tfrac{1}{2}}{100}\right);$$

$$\therefore \text{ on } £1000 \text{ I gain } £\left(50+\frac{25\times2\tfrac{1}{2}}{100}-30\right), \text{ or } £\left(20+\frac{125}{200}\right);$$

$$\therefore 20+\frac{25}{40} : 660 :: £1000 : \text{sum required};$$

$$\therefore \text{ sum required} = £\,\frac{660\times1000\times40}{825} = £\,\frac{60\times1000\times40}{75} = £32000.$$

12. Square of 4 : square of 6 :: expense of a four-oared boat : expense of a six-oared boat;

$$\therefore 16 : 36 :: £50 : \text{cost required};$$

$$\therefore \text{ cost required} = £\frac{50 \times 36}{16} = £112.\ 10s.$$

$$\text{Also cost of 4-oared boat per head} = £\frac{50}{4} = £12.\ 10s.;$$

$$\text{and cost of 6-oared boat per head} = \frac{£112.\ 10s.}{6} = £18.\ 15s.;$$

$\therefore$ the former is the cheaper.

XII. (p. 309.)

1. $${\cdot}2 \times {\cdot}2 \times {\cdot}2 = {\cdot}008.$$

2. $193{\cdot}47 : 21121967 :: 100 :$ population in 1801;

$$\therefore \text{ population} = \frac{21121967 \times 100}{193{\cdot}47}$$

$$= \frac{211219670000}{19347}$$

$$= 10917437 \text{ nearly.}$$

3. The difference $= 20$ min., $19{\cdot}9$ sec. $= 1219{\cdot}9$ seconds,

and in 365 d. 5 h. 48′. 49·7″ there are 31556929·7 seconds;

$$\therefore \text{ decimal} = \frac{1219{\cdot}9}{31556929{\cdot}7} = {\cdot}000038\ldots$$

4. $$80000 - 4500 = 75500, \text{ and } 9 - 6 = 3;$$

$\therefore$ 75500 cwt. have to be removed in 3 days;

$$\therefore \left.\begin{array}{rcl} 3 & : & 6 \\ 4500 & : & 75500 \end{array}\right\} :: 18 : \text{number of horses required;}$$

$$\therefore \text{ number of horses} = \frac{75500 \times 6 \times 18}{4500 \times 3} = 151 \times 2 \times 2 = 604.$$

5. $$\frac{5}{12} \text{ of } £4\tfrac{1}{2} = £\frac{15}{8};$$

$$\therefore 100 + \frac{15}{8} : 775{\cdot}6125 :: £\frac{15}{8} : \text{discount required;}$$

$$\therefore \text{ discount} = £\frac{775{\cdot}6125 \times 15 \times 8}{815 \times 8}$$

$$= £\frac{2326{\cdot}8375}{163} = £14{\cdot}2750 \text{ nearly} = £14.\ 2\text{ f. } 7\text{ c. } 5\text{ m. nearly.}$$

6. Interest on £100 in first case $=£\dfrac{100\times 3}{83\frac{1}{4}}=£\dfrac{1200}{333}=£\dfrac{400}{111}$,

$$\text{interest on £100 in second case}=£\frac{100\times 3\frac{1}{4}}{83\frac{7}{8}}=£\frac{100\times 13\times 2}{671}=£\frac{2600}{671}.$$

Now we have to compare the fractions $\dfrac{4}{111}$ and $\dfrac{26}{671}$,

and they are equal to $\dfrac{2684}{111\times 671}$ and $\dfrac{2886}{111\times 671}$,

and, therefore, he would increase his income.

7. In 4 months he makes 15 per cent. on his outlay;

$\therefore$ in a year $3\times 15=45$ per cent.,

whereas in 6 months, under the other supposition, he makes 20 per cent.;

$\therefore$ in a year $20\times 2=40$ per cent.,

so the first is the better mode of selling.

8. Let x=number of minute divisions over which the hour-hand has passed,

$12x=$ .... minute-hand ....

Then

(1) $$12x=35+x-30,$$

$$11x=5,$$

$x=\dfrac{5}{11}$ min., $\therefore$ the time is $5\frac{5}{11}'$ past 7 when the hands are exactly opposite.

(2) $$12x=35+x-15,$$

$$11x=20,$$

$x=1\frac{9}{11}'$, $\therefore$ the time is $21\frac{9}{11}'$ past 7 when the hands are at right angles,

or $12x=35+x+15$,

$$11x=50,$$

$x=4\frac{6}{11}'$, $\therefore$ the time is $54\frac{6}{11}'$ past 7 when the hands are at right angles.

(3) $$12x=35+x,$$

$$11x=35,$$

$$x=3\tfrac{2}{11},$$

$\therefore$ the time is $38\frac{2}{11}'$ past 7 when the hands are coincident.

9. In one hour A and B do $\frac{1}{4}$,

A and C do $\frac{5}{18}$,

B and C do $\frac{7}{36}$;

$$\therefore 2A \text{ and } 2B \text{ and } 2C \text{ do } \frac{1}{4}+\frac{5}{18}+\frac{7}{36}=\frac{52}{72};$$

$$\therefore A, B, \text{ and } C \text{ do } \frac{26}{72} \text{ or } \frac{13}{36};$$

$$\therefore A \text{ can do } \frac{13}{36}-\frac{7}{36}=\frac{6}{36}=\frac{1}{6},$$

$$B \text{ can do } \frac{13}{36}-\frac{5}{18}=\frac{3}{36}=\frac{1}{12},$$

$$C \text{ can do } \frac{13}{36}-\frac{1}{4}=\frac{4}{36}=\frac{1}{9};$$

$\therefore$ A can do the work in 6 hours, B in 12 hours and C in 9 hours.

10. $$\text{Area}=\left(\frac{51}{2}\times\frac{73}{4}\right) \text{ sq. ft.};$$

$$\therefore \text{ number of feet of carpet required}=\frac{51\times 73}{2\times 4\times 2};$$

$$\therefore \text{ number of yards}=\frac{51\times 73}{2\times 4\times 2\times 3};$$

$$\therefore \text{ price}=\frac{51\times 73\times 4}{2\times 4\times 2\times 3}\,s.=\frac{1241}{4}\,s.=£15.\ 10s.\ 3d.$$

11. $$£15000-(£3000+£1050)=£10950;$$

$$\therefore \text{ annual value of the estate}=£\,\frac{10950}{25}=£438.$$

12. $$£1=55\tfrac{1}{4} \text{ lire}$$

$$=55\tfrac{1}{4}\times\frac{1}{4\frac{1}{4}} \text{ marks}$$

$$=55\tfrac{1}{4}\times\frac{1}{4\frac{1}{4}}\times\frac{19}{10} \text{ francs}$$

$$=\frac{221\times 4\times 19}{4\times 17\times 10} \text{ francs}$$

$$=\frac{13\times 19}{10} \text{ francs}=24{\cdot}7 \text{ francs};$$

$\therefore$ circuitous remittance is the more advantageous.

XIII. (p. 310.)

1. $21s. : 2s.\ 9\tfrac{3}{5}d. :: 5s. :$ sum required;

$$\therefore \text{ sum required} = \frac{5 \times 33\frac{3}{5}}{21}d. = \frac{168}{21}d. = 8d.$$

2. £150 in one year produces £4½ interest.

Also amount of interest $= £165{\cdot}75 - £150 = £15{\cdot}75$

$$\therefore \text{ number of years} = \frac{15{\cdot}75}{4{\cdot}5} = 3{\cdot}5 = 3\tfrac{1}{2}.$$

3. $57 \times 35s. = 1995s. = £99.\ 15s.$ the sum he receives for the sheep;

$105 : 100 :: £120 :$ present value of £120;

$$\therefore \text{ present value of } £120 = £\frac{120 \times 100}{105} = £\frac{800}{7} = £114.\ 5s.\ 8\tfrac{4}{7}d.;$$

$\therefore$ he loses $£114.\ 5s.\ 8\tfrac{4}{7}d. - £99.\ 15s. = £14.\ 10s.\ 8\tfrac{4}{7}d.$

4.

$$\begin{array}{r|l}
2 & 1,\ 2,\ 3,\ 4,\ 5,\ 6,\ 7,\ 8 \\ \hline
2 & 1,\ 1,\ 3,\ 2,\ 5,\ 3,\ 7,\ 4 \\ \hline
3 & 1,\ 1,\ 3,\ 1,\ 5,\ 3,\ 7,\ 2 \\ \hline
 & 1,\ 1,\ 1,\ 1,\ 5,\ 1,\ 7,\ 2
\end{array}$$

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 5 \times 7 \times 2 = 840$;

$$\therefore \text{ time after which the bells toll together is } \frac{840'}{60} = 14'.$$

5.

$$\begin{array}{r|r@{\ .\ }r@{\ .\ }rl}
 & \pounds & s. & d. & \\
 & 391 & 9 & 2 & \\
 & \multicolumn{3}{r}{3} & \\ \cline{2-4}
 & 1174 & 7 & 6 & \\
 & \multicolumn{3}{r}{7} & \\ \cline{2-4}
 & 8220 & 12 & 6 & = \text{whole expenditure from 1830 to 1850.} \\
 & 391 & 16 & 0 & = \text{expenditure for 1830.} \\ \cline{2-4}
 & 7828 & 16 & 6 & \\
 & 445 & 8 & 9 & = \text{expenditure for 1851.} \\ \cline{2-4}
3 & 8274 & 5 & 3 & \\ \cline{2-4}
7 & 2758 & 1 & 9 & \\ \cline{2-4}
 & \pounds 394 & 0 & 3 & = \text{average expenditure from 1831 to 1851.}
\end{array}$$

6.

$$\begin{aligned}
£10 &= 10 \times 9\tfrac{1}{2} \text{ silver gulden} \\
&= 10 \times 9\tfrac{1}{2} \times \frac{120}{100} \text{ paper gulden} \\
&= 114 \text{ paper gulden.}
\end{aligned}$$

7. If 17 men could finish the work in 30—12, or 18 days: how long will it take 17—9, or 8 men to do it?

$$8 : 17 :: 18 : \text{number of days required};$$

$$\therefore \text{number of days} = \frac{17 \times 18}{8} = \frac{153}{4} = 38\tfrac{1}{4}.$$

8. Weight of pure silver in a shilling $= \left(\frac{37}{40} \text{ of } 87\right)$ grains $= \frac{3219}{40}$ grains;

$$\therefore 108 : 100 :: \frac{3219}{40} : \text{weight of the shilling when silver has risen in value};$$

$$\therefore \text{weight of shilling} = \frac{3219 \times 100}{108 \times 40} \text{ grains};$$

$$\therefore \text{diminution} = \left(\frac{3219}{40} - \frac{3219 \times 100}{108 \times 40}\right) \text{ grains},$$

$$= \frac{3219}{540} \text{ grains} = 5\tfrac{173}{180} \text{ grains}.$$

9.

$$56 \text{ cub. ft. } 568 \text{ cub. in.} = 97336 \text{ cub. in.},$$

$$\text{and } \sqrt[3]{97336} = 46 \text{ in.} = 3 \text{ ft. } 10 \text{ in.}$$

10.

$$£116.\ 17s. : £132.\ 4s.\ 6d. :: 95 : 100 + \text{gain per cent.};$$

$$\therefore 100 + \text{gain per cent.} = \frac{31734 \times 95}{28044} = 107\tfrac{1}{2};$$

$$\therefore \text{gain per cent.} = 7\tfrac{1}{2}.$$

11.

$$\text{Weekly rental} = 20(7 + 6 + 5 + 4 + 3\tfrac{1}{2} + 3)s.$$

$$= (20 \times 28\tfrac{1}{2})s. = £28.\ 10s.,$$

$$\text{yearly rental} = (£28.\ 10s.) \times 52 = £1482;$$

$$\text{yearly net receipts} = £(1482 - 20) = £1462;$$

$$\therefore 6000 : 100 :: £1462 : \text{rate of profit};$$

$$\therefore \text{rate of profit} = £\frac{100 \times 1462}{6000} = £\frac{731}{30} = £24.\ 7s.\ 4d. \text{ per cent.}$$

12.

$$\text{He mows in 1 hour } \left(\frac{4}{10} \text{ of } 1760\right) \text{ yds. in length.}$$

$$\therefore \text{in 72 minutes he mows } \frac{4 \times 1760 \times 72}{10 \times 60} \text{ yds. in length};$$

$$\therefore \text{breadth} = \left(1056 \div \frac{4 \times 1760 \times 72}{10 \times 60}\right) \text{ yds.}$$

$$= \frac{1056 \times 10 \times 60}{4 \times 1760 \times 72} \text{ yds.} = \frac{5}{4} \text{ yds.} = 1\tfrac{1}{4} \text{ yds.}$$

XIV. (p. 311.)

1. $2825566{\cdot}2 \div 34{\cdot}002 = 83100,$

$\cdot 028255662 \div 34{\cdot}002 = \cdot 000831.$

2. On his bad debts he receives £600;

∴ his assets are £(1800 + 600) = £2400;

∴ 6000 : 2400 :: 20*s.* : what he pays in the pound;

$$\therefore \text{ he pays in the pound } \frac{20 \times 2400}{6000}\,s. = \frac{48}{6}\,s. = 8s.$$

3.

$$\begin{array}{r|rrrrrl}
 & \text{£} & & s. & & d. & \\
2\text{ qrs.} = \frac{1}{2} & 3 & . & 0 & . & 7 & = \text{value of 1 cwt.} \\
 & & & & & 7 & \\
\hline
 & 21 & . & 4 & . & 1 & = \text{value of 7 cwt.} \\
14\text{ lbs.} = \frac{1}{4} & 1 & . & 10 & . & 3\frac{1}{2} & = \text{value of 2 qrs.} \\
1\text{ lb.} = \frac{1}{14} & & & 7 & . & 6\frac{7}{8} & = \text{value of 14 lbs.} \\
\frac{1}{2}\text{ lb.} = \frac{1}{2} & & & & & 6\frac{55}{112} & = \text{value of 1 lb.} \\
 & & & & & 3\frac{55}{224} & = \text{value of } \frac{1}{2}\text{ lb.} \\
\hline
 & \text{£}23 & . & 2 & . & 9\frac{25}{224} & = \text{value of 7 cwt. 2 qrs. } 15\frac{1}{2}\text{ lbs.}
\end{array}$$

4. For £100 stock he pays $\text{£}\left(91\frac{1}{4} + \frac{1}{8}\right) = \text{£}91\frac{3}{8}$.

On £100 stock he receives £3—2*s.* 6*d.* = $\text{£}2\frac{7}{8}$;

∴ $91\frac{3}{8} : 3411\frac{1}{3} :: \text{£}2\frac{7}{8}$: annual income;

$$\therefore \text{ annual income} = \text{£}\frac{10234 \times 23 \times 8}{731 \times 3 \times 8}$$

$$= \text{£}\frac{322}{3} = \text{£}107.\ 6s.\ 8d.$$

5.

$$\begin{aligned}
\text{£}1 &= \frac{20}{3} \text{ thalers} \\
&= \frac{20}{3} \times \frac{93}{25} \text{ francs} \\
&= \frac{20}{3} \times \frac{93}{25} \times \frac{5}{27} \text{ scudi} \\
&= \frac{20}{3} \times \frac{93}{25} \times \frac{5}{27} \times \frac{135}{62} \text{ gulden} \\
&= 10 \text{ gulden.}
\end{aligned}$$

6. £100 amounts to £120 in 5 years at 4 per cent.,

∴ 120 : 100 :: £111 : amount required;

$$\therefore \text{ amount required} = \text{£}\frac{100 \times 111}{120} = \text{£}92\frac{1}{2} = \text{£}92.\ 5\text{fl.}$$

7.

$$\text{Let } x = A\text{'s share,}$$
$$2x = B\text{'s share,}$$
$$\frac{10x}{4} = C\text{'s share,}$$
$$\frac{10x \times 6}{4 \times 5} = D\text{'s share,}$$
$$\frac{10x \times 6 \times 4}{4 \times 5 \times 3} = E\text{'s share;}$$
$$\therefore x + 2x + \frac{5x}{2} + 3x + 4x = 2025;$$
$$\therefore 25x = 4050;$$
$$\therefore x = 162;$$

∴ A's share is £162; B's share is £324; C's share is £405; D's share is £486; E's share is £648.

8.

$$\text{In one day } A \text{ can do } \frac{1}{27};$$
$$\therefore \text{ in 12 days } A \text{ does } \frac{12}{27}, \text{ or } \frac{4}{9};$$
$$\therefore \frac{5}{9} \text{ remains to be done.}$$
$$\text{In one day } B \text{ can do } \frac{1}{15};$$
$$\therefore \text{ in 5 days } B \text{ can do } \frac{1}{3};$$
$$\therefore \frac{5}{9} - \frac{1}{3}, \text{ or } \frac{2}{9} \text{ remains for } C \text{ to do;}$$
$$\therefore C \text{ does } \frac{1}{4} \text{ of } \frac{2}{9}, \text{ or } \frac{1}{18} \text{ daily;}$$
$$\therefore C \text{ could do the whole work in 18 days.}$$

9.

$$\sqrt{3080\tfrac{1}{4}} = \sqrt{\frac{12321}{4}} = \frac{111}{2} = 55\tfrac{1}{2},$$
$$\sqrt[3]{9{\cdot}528128} = 2{\cdot}12,$$
$$\text{hypothenuse} = \sqrt{(4)^2 + \left(\frac{5}{3}\right)^2} = \sqrt{16 + \frac{25}{9}} = \sqrt{\frac{169}{9}} = \frac{13}{3} \text{ ft.} = 4 \text{ ft. } 4 \text{ in.}$$

10.

Income-tax on £149½ at 5*d.* = £3. 2*s.* 3½*d.*;

∴ £149. 10*s.* – £3. 2*s.* 3½*d.* = £146. 7*s.* 8½*d.*,

and £146. 7*s.* 8½*d.* – 7¾*d.* = £146. 7*s.* 0¾*d.*

Then 19*s*. 5*d*. : 20*s*. :: £146. 7*s*. 0¾*d*. : income of the richer man;

$$\therefore \text{income} = \frac{140499 \times 20}{932}\,s. = 3015s. = £150.\ 15s.$$

11. He takes £33 + 10*s*. + 14*s*. = £34. 4*s*. = £34·2,

and (34·2 × 26·25) francs = 897·75 francs;

∴ he has left (897·75 — 577·50) francs = 320·25 francs;

∴ 26·25 : 320·25 :: 10 fl. : number of florins he receives;

$$\therefore \text{number of florins} = \frac{32025 \times 10}{2625} = 122.$$

12. He buys $£\frac{90000 \times 100}{92}$ stock, or $£\frac{2250000}{23}$, or $£97826\frac{2}{23}$.

$$\text{His income from it} = £\frac{90000 \times 3}{92} = £\frac{22500 \times 3}{23} = £2934\tfrac{18}{23}.$$

$$\text{Now of the new stock he might have had } £\frac{110 \times 90000}{100};$$

$$\therefore \text{income would have been } £\frac{110 \times 90000 \times 2\frac{1}{2}}{100 \times 100} = £990 \times 2\tfrac{1}{2} = £2475;$$

$$\therefore \text{difference} = (£2934\tfrac{18}{23} - 2475) = £459\tfrac{18}{23}.$$

XV. (p. 312.)

1. 640 horses go the whole voyage,

10 horses go only $\frac{1}{4}$ of the voyage.

Let x = number of days in the voyage,

then x = number of shillings each horse cost for the whole voyage;

$$\therefore 640x + \frac{10x}{4} = 1542 \times 20;$$

$$\therefore 2560x + 10x = 123360;$$

$$\therefore x = 48.$$

2. £5 : 13*s*. 4*d*. :: £100 : amount of each share;

$$\therefore \text{amount of share} = £\frac{100 \times \frac{2}{3}}{5} = £\frac{40}{3} = £13.\ 6s.\ 8d.,$$

and price at $\frac{7}{8}$ premium = £13. 6*s*. 8*d*. + 17*s*. 6*d*. = £14. 4*s*. 2*d*.

Then £14. 4*s*. 2*d*. : £100 :: 13*s*. 4*d*. : interest required;

$$\therefore \text{ interest per cent.} = £\,\frac{100 \times 160}{3410} = £4\tfrac{236}{341}.$$

3. 2 cub. ft. 61$\frac{5}{7}$ cub. in. : 1 cub. ft. :: 1 cwt. 19 lbs. 13 oz. : weight required;

$$\therefore \text{ weight required} = \frac{2109 \times 1728}{3517\frac{5}{7}} \text{ oz.} = \frac{25510464}{24624} \text{ oz.} = 1036 \text{ oz.} = 64 \text{ lbs. } 12 \text{ oz.}$$

4. Amount of stock purchased in former company $= £\,\dfrac{500 \times 100}{97}$;

.... latter .... $= £\,\dfrac{500 \times 100}{95}$.

Also for the former stock he obtains $£\,\dfrac{500 \times 100 \times 104}{97 \times 100}$;

and for the latter .... $£\,\dfrac{500 \times 100 \times 90}{95 \times 100}$;

$$\therefore \text{ he obtains in all } £\,\frac{500 \times 104}{97} + £\,\frac{500 \times 90}{95}$$

$$= £500\left(\frac{104}{97} + \frac{90}{95}\right)$$

$$= 500 \times £\,\frac{3722}{1843} = £\,\frac{1861000}{1843} = £1009\tfrac{1413}{1843};$$

$$\therefore \text{ he gains } £9\tfrac{1413}{1843}.$$

5. Let $23x$ be the number of oz. in 2617 sovereigns;

then $21x$ will be the oz. of gold,

and $2x$ will be the oz. of alloy.

Then since £3. 17. 10$\frac{1}{2}$*d*. = 1869 half-pence,

$$21x \times 1869 + 2x \times 3 = 2617 \times 20 \times 12 \times 2,$$

$$\therefore 39255x = 2617 \times 20 \times 12 \times 2;$$

$$\therefore x = 32.$$

Hence ounces of gold $= 32 \times 21 = 672$,

and ounces of alloy $= 32 \times 2 = 64$.

6. $(30 \times 600 \times 1760 \times 4 \times 3)$ cub. ft. run into the sea each hour;

$$\therefore \text{ number of cubic feet which run in per minute} = \frac{30 \times 600 \times 1760 \times 4 \times 3}{60}$$

$$= 6336000.$$

Now weight of this body of water = (6336000 × 1000) oz.
= 396000000 lbs.
= 176785 tons 14 cwt. 32 lbs.

7. 3 lbs. at 7*d.* cost 21*d.*,
5 lbs. at 10*d.* cost 50*d.*;
∴ 8 lbs. of mixture cost 71*d.*,
and 8 lbs. of mixture sell for 72*d.*;
∴ 71*d.* : 1*d.* :: £100 : gain per cent.;
$$\therefore \text{gain per cent.} = £\frac{100}{71} = £1\tfrac{29}{71}.$$

8. $$\text{Cubic content in links} = 9450 \times 105 \times \frac{63}{2}$$
= 31255875 links,
and since 1 cub. chain = 100 × 100 × 100 = 1000000 cub. links,
∴ content = 31 cub. chains 255875 cub. links.

9. On each £100 stock he loses $(£96\tfrac{7}{81} - 82\tfrac{3}{4}) = £\left(\frac{7783}{81} - \frac{331}{4}\right) = £\frac{4321}{324}$;
$$\therefore \text{he loses } £\left(\frac{4321}{324} \times 5\right) = £\frac{21605}{324} = £66.\ 13s.\ 7\tfrac{19}{27}d.$$

10. At the end of the first year he owes £3000 + £150 — £500 = £2650,
at the end of the second year he owes £2650 + £132. 10*s.* — £500 = £2282. 10*s.*,
at the end of the third year he owes £2282. 10*s.* + £114. 2*s.* 6*d.* — £500
= £1896. 12*s.* 6*d.*

11. Let x = breadth of wall in feet,
then $x \times 5x \times 40x = 18225$;
$\therefore 200x^3 = 18225$;
$$\therefore x^3 = \frac{18225}{200} = \frac{729}{8};$$
$$\therefore x = \sqrt[3]{\frac{729}{8}} = \frac{9}{2} = 4\tfrac{1}{2} \text{ feet.}$$

12. 4 per cent. on £300000 = £12000;
∴ gross proceeds = £12000 + £15691. 13*s.* 4*d.*
= £27691. 13*s.* 4*d.*,

also, since a £10 share is purchased for £8,

$$8 : 10 :: £4 : \text{per centage required};$$

$$\therefore \text{per centage} = £\,\frac{10 \times 4}{8} = £5.$$

XVI. (p. 313.)

1. $$\text{No. of feet in walls} = 2 \times 12\tfrac{1}{3}\{16 + 14\tfrac{1}{4}\}$$
$$= 2 \times 12\tfrac{1}{3} \times 30\tfrac{1}{4}$$
$$= \frac{2 \times 37 \times 121}{3 \times 4}\ \text{sq. ft.};$$

$$\therefore \text{number of feet of paper required} = \frac{2 \times 37 \times 121}{3 \times 4} \div 2\tfrac{1}{2}$$
$$= \frac{2 \times 37 \times 121 \times 2}{3 \times 4 \times 5}\ \text{ft.}$$

$$\therefore \text{number of yards} = \frac{2 \times 37 \times 121 \times 2}{3 \times 4 \times 5 \times 3};$$

$$\therefore \text{cost} = \left(\frac{2 \times 37 \times 121 \times 2}{3 \times 4 \times 5 \times 3} \times 3\tfrac{1}{2}\right) s. + \frac{2 \times 37 \times 121}{3 \times 4 \times 4 \times 12} s.$$
$$= \frac{74 \times 121}{3 \times 12}\left(\frac{7}{5} + \frac{1}{16}\right) s.$$
$$= \frac{37 \times 121 \times 117}{3 \times 6 \times 80} s. = \frac{523809}{1440} s. = £18.\ 3s.\ 9\tfrac{3}{40}d.$$

2. $$\begin{array}{r|l} 2 & 1{\cdot}0 \\ 12 & 7{\cdot}5 \\ 20 & 15{\cdot}625 \\ & {\cdot}78125 \end{array}$$

$$\therefore £37.\ 15s.\ 7\tfrac{1}{2}d. = £37{\cdot}78125$$
$$= £37.\ 7\ \text{f.}\ 8\ \text{c.}\ 1\tfrac{1}{4}\ \text{m.}$$

$$\text{Also 1 farthing—1 mil} = £\left(\frac{1}{960} - \frac{1}{1000}\right) = £\,\frac{1}{24000} = \frac{1}{25} q.$$

3. Let x = weight of the piece in oz.,

then $\dfrac{925x}{100}$ = weight of gold in oz.,

$\dfrac{75x}{1000}$ = weight of silver in oz.;

$$\therefore \frac{925x}{1000} \times 85 + \frac{75x}{1000} \times 5\tfrac{1}{2} = 15,$$

$$\text{or } \frac{925x}{1000} \times 17 + \frac{15x}{1000} \times \frac{11}{2} = 3,$$

$$\text{or } 15725x + \frac{165x}{2} = 3000\,;$$

$$\therefore x = \frac{6000}{31615}\text{ oz.} = \frac{120000}{31615}\text{ dwts.} = 3\text{ dwts. } 19\tfrac{823}{6323}\text{ grs.}$$

N.B. The result given in the Answers is obtained by considering 92·5 per cent. to be the proportion of *value* and not of *weight.*

4. Content of cistern = (1000 + 1728) inches = 2728 inches.

$$\text{Area of base} = \left(\frac{121}{81} - \frac{100}{81}\right)\text{ sq. ft.} = \left(\frac{21}{81} \times 144\right)\text{ sq. inches;}$$

$$\therefore \text{depth} = \left(2728 \div \frac{21 \times 144}{81}\right)\text{ inches}$$

$$= \frac{2728 \times 81}{21 \times 144}\text{ inches} = \frac{1023}{14}\text{ inches} = 73\tfrac{1}{14}\text{ in.}$$

5. $$\text{Number of paid letters} = \frac{450000 \times 92}{100} = 414000\,;$$

$$\therefore \text{number of stamped letters} = \frac{414000 \times 51}{100} = 211140.$$

6. *A* in $2\frac{1}{2}$ hours will have gained a start of $(3\frac{1}{4} \times 2\frac{1}{2})$ miles, or $\frac{13 \times 5}{4 \times 2}$ miles,

B gains on *A* at the rate of $1\frac{1}{4}$ mile an hour;

$$\therefore \text{number of hours required} = \frac{13 \times 5}{4 \times 2} \div \frac{5}{4}$$

$$= \frac{13 \times 5 \times 4}{4 \times 2 \times 5} = 6\tfrac{1}{2}\text{ hrs.}$$

7. 1 lb. Troy = 5760 gr. Troy,

1 lb. Av. = 7000 gr. Troy;

$$\therefore 1\text{ lb. Av.} = \frac{7000}{5760}\text{ of a lb. Troy} = \frac{175}{144}\text{ of a lb. Troy;}$$

$$\therefore 28\text{ lb. } 5\text{ oz. Av.} = \left(28\tfrac{5}{16}\text{ of }\frac{175}{144}\right)\text{ lbs. Troy}$$

$$= \frac{453 \times 175}{16 \times 144}\text{ lbs. Troy}$$

$$= \frac{26425}{768}\text{ lbs. Troy}$$

$$= 34\text{ lbs. } 4\text{ oz. } 17\text{ dwts. } 19{\cdot}5\text{ grs.}$$

8. In 4 h. 50 min. of its own time it loses 10 min.;

what then will it lose in 5 h. of its own time?

$4\frac{5}{6} : 5 :: 10' :$ number of minutes;

$$\therefore \text{ number of minutes} = \frac{10 \times 5 \times 6}{29} = 10\tfrac{10}{29}' = 10'\ 20\tfrac{20}{29}'';$$

$$\therefore \text{ true time is } 5\text{ h. } 10'\ 20\tfrac{20}{29}''.$$

9. 1 cubic foot = 1728 cubic inches;

$$\therefore \text{ thickness} = \frac{1728}{402600000}\text{ in.} = \frac{288}{67100000}\text{ in.} = \cdot 0000042921\ldots\text{in.}$$

10. His dividends amount to $100 \times (15s.\ 4d. + 20s.\ 10d. + 30s.\ 4d. + 38s.\ 9d.)$

$= 100 \times (105s.\ 3d.) = £526.\ 5s.,$

also, gain on shares $= (£35 \times 43) = £1505$;

$\therefore$ whole gain $= £1505 + £526.\ 5s. = £2031.\ 5s.$

11. Whole outlay $= (7s.\ 10\frac{1}{2}d.) \times 236 = £92.\ 18s.\ 6d.$

	£	s.	d.
59 yds. sold at 10*s.* 3*d.* brought him	30	4	9
$78\frac{2}{3}$ yds. sold at 8*s.* 6*d.* brought him	33	8	8
$98\frac{1}{3}$ yds. sold at 7*s.* brought him	34	8	4
proceeds of sales =	£98	1	9

$\therefore$ gain $= £98.\ 1s.\ 9d. - £92.\ 18s.\ 6d. = £5.\ 3s.\ 3d.$

Then $£92.\ 18s.\ 6d. : £100 :: £5.\ 3s.\ 3d. :$ gain per cent.;

$$\therefore \text{ gain per cent.} = \frac{100 \times 20 \times 12 \times 103\frac{1}{4}}{22302}\,s.$$

$$= \frac{1000}{9}\,s. = 111\tfrac{1}{9}s. = £5.\ 11s.\ 1\tfrac{1}{3}d.$$

12. Cost of shares $= £1000 - £8.\ 12s.\ 6d. = £991.\ 7s.\ 6d.$;

$$\therefore \text{ number of shares} = \frac{991\frac{3}{8}}{12\frac{7}{8}} = \frac{7931}{103} = 77;$$

$\therefore$ value of his shares in company's books $= (£77 \times 20) = £1540$;

$\therefore 100 : 1540 :: £3 :$ yearly income;

$$\therefore \text{ yearly income} = £\frac{1540 \times 3}{100} = £\frac{231}{5} = £46.\ 4s.$$

XVII. (p. 318.)

1. It is plain that the hands will not be together again till after one o'clock. Let x = number of minute divisions passed over by hour-hand after 1 o'clock,

$12x$ = ... minute-hand ....

$$\text{Then } 12x=5+x; \quad \therefore 11x=5, \quad \therefore x=\frac{5}{11}\text{ min.}$$

$$\text{So the time is } \frac{60}{11}\text{ min. or } 5\tfrac{5}{11}' \text{ past 1.}$$

2. An acre of turnips is worth £7,

$$\text{an acre of beet is worth £}\frac{1\frac{1}{2}\times 7}{1\frac{1}{3}}=\text{£}\frac{63}{8},$$

$$\text{an acre of cabbages is worth £}\frac{1\frac{1}{4}\times 7}{1\frac{1}{3}}=\text{£}\frac{105}{16}.$$

Let x = number of acres of turnips,

$\frac{9x}{8}$ = ... beet,

$\frac{15x}{16}$ = ... cabbages;

$$\therefore x+\frac{9x}{8}+\frac{15x}{16}=7; \quad \therefore x=\frac{112}{49}=\frac{16}{7};$$

$$\therefore \text{value of turnips}=\text{£}\left(\frac{16}{7}\times 7\right)=\text{£}16.,$$

$$\text{value of beet}=\frac{9}{8}\times\frac{16}{7}\times\text{£}\frac{63}{8}=\text{£}\frac{81}{4}=\text{£}20.\ 5s.,$$

$$\text{value of cabbages}=\frac{15}{16}\text{ of }\frac{16}{7}\text{ of £}\frac{105}{16}=\text{£}\frac{225}{16}=\text{£}14.\ 1s.\ 3d.;$$

$$\therefore \text{value of all the crops}=\text{£}16+\text{£}20.\ 5s.+\text{£}14.\ 1s.\ 3d.=\text{£}50.\ 6s.\ 3d.$$

3. Let x = number of spaces passed over since 3 o'clock by the hour-hand,

$12x$ = ... min.-hand.

$$\text{Then } 12x=x+15+30,$$
$$11x=45,$$
$$x=4\tfrac{1}{11};$$
$$\therefore \text{time is } 49\tfrac{1}{11}' \text{ past 3.}$$

4. In one minute first tap fills $\frac{1}{20}$ of the cistern,

.... second ...... $\frac{1}{24}$ ....,

.... third tap empties $\frac{1}{30}$ ....;

∴ in 15 minutes, when all are open together,

$$\text{part filled} = 15\left(\frac{1}{20} + \frac{1}{24} - \frac{1}{30}\right) = \frac{15 \times 7}{120} = \frac{7}{8}.$$

5. Circumference of wheel $= (5 \times 3{\cdot}1416) = 15{\cdot}708$ feet;

∴ number of ft. passed over in 2500 revolutions should $= 15{\cdot}708 \times 2500 = 39270$.

Now 6 miles $= (1760 \times 3 \times 6)$ feet $= 31680$ feet;

∴ distance lost by slipping $= (39270 - 31680)$ feet

$= 7590$ ft. $= 2530$ yds. $= 1{\cdot}4375$ miles.

7. $3{\cdot}937 \times 3{\cdot}937 \times 3{\cdot}937 = 15{\cdot}499969 \times 3{\cdot}937$

$= 61{\cdot}023377953$ cub. inches.

8.

$$\left.\begin{array}{l} 20 : 15 \times 3 \\ 11\frac{1}{4} : 5 \\ 31\frac{1}{2} : 14 \\ 80 : 160 \end{array}\right\} :: 9 : \text{number of days required};$$

$$\therefore \text{number of days} = \frac{15 \times 3 \times 5 \times 14 \times 160 \times 9 \times 2 \times 4}{20 \times 45 \times 63 \times 80} = 8.$$

9. 92 : 100 :: 3 : interest for 9 months on £100;

$$\therefore \text{interest on £100 for 9 months} = £\frac{100 \times 3}{92} = £\frac{75}{23};$$

$$\therefore £100 + £\frac{75}{23} : £130.\ 0s.\ 7\tfrac{1}{2}d. :: £100 : \text{present worth};$$

$$\therefore \text{present worth} = \frac{31207\frac{1}{2} \times 100}{\frac{2375}{23}}d. = \frac{62415 \times 100 \times 23}{2375 \times 2}d.$$

$$= \frac{12483 \times 2 \times 23}{95}d. = (657 \times 2 \times 23)d.$$

$$= 30222d. = £125.\ 18s.\ 6d.$$

10. Annual increase $= 2{\cdot}5$ per cent.

Taking then the formula for compound interest $M = P(1+r)^n$;

$$\therefore \text{increase in 100 after 5 years} = 100\left(1 + \frac{2{\cdot}5}{100}\right)^5$$

$$= 100\left(1 + \frac{25}{1000}\right)^5$$

$$= 100\left(1 + \frac{1}{40}\right)^5$$

$$= 100 \times \left(\frac{41}{40}\right)^5$$

$$= \frac{115856201}{1024000} = 113{\cdot}1408\ldots$$

∴ increase is 13·1408... per cent.

Again, if x = population,

$$\frac{5x}{1000} = \text{number of emigrants in first year};$$

$$\text{also population in second year} = \frac{102 \cdot 5x}{100};$$

$$\therefore \text{number of emigrants in second year} = \frac{5}{1000} \text{ of } \frac{102 \cdot 5x}{100};$$

$$\therefore \frac{5x}{1000} + \frac{512 \cdot 5x}{100000} = 81000;$$

$$\therefore 5000x + 5125x = 81000000000;$$

$$\therefore x = \frac{81000000000}{10125} = 8000000.$$

11. $124\tfrac{1}{2} : 100 :: £5 :$ rate of interest in first company;

$$\therefore \text{first rate} = £\frac{500 \times 2}{249} = £\frac{1000}{249};$$

$$\text{guaranteed interest on each share in second company} = £\frac{7\tfrac{1}{2} \times 4\tfrac{5}{6}}{100} = £\frac{29}{80};$$

$$\therefore 8\tfrac{1}{2} : 100 :: £\frac{29}{80} : \text{rate of interest in second company};$$

$$\therefore \text{second rate} = £\frac{29 \times 100 \times 2}{17 \times 80} = £\frac{145}{34};$$

$$\begin{aligned} \therefore \text{first rate} : \text{second rate} &:: \frac{1000}{249} : \frac{145}{34} \\ &:: 1000 \times 34 : 145 \times 249 \\ &:: 6800 : 7221. \end{aligned}$$

12. $(52\tfrac{1}{2} \times 5\tfrac{5}{6})\text{sq. ft.} = \frac{1225}{4}\text{sq. ft.} = 306\tfrac{1}{4}\text{sq. ft.}$

Content of box = $(63 \times 36 \times 33)$ cubic inches,

$$\text{content of each book} = \frac{21}{2} \times \frac{9}{2} \times \frac{11}{8} \text{ cubic inches};$$

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